VOL. XXXVII, No. 4, 1954

MMONWEALTH INST.
TOMOLOGY LIBRARY
1 6 FEB 1955
RIAL As.17
EPARATE
EXD.

THE

MALAYAN AGRICULTURAL JOURNAL

PRINCIPAL CONTENTS

Cacao Propagation in Malaya with Special Reference to Cacao Nursery Technique by C. Whitehead, B.Sc. (Hort.), D.T.A.

The Marketing of Durian Fruit from Parit District, Perak by T. B. Wilson, B.A. (Oxon.), Dip. Agric. Econ., D.T.A.

The Development and Design of a Hagotan for the Extraction of Manila Hemp Fibre by D. S. Boyce, B.Sc. (Agric.) (McGill), M.Sc. (Dunelm), Asst. M.A.S.A.E.

Notes on Current Investigations, Research, July to September, 1954.

Notes on Current Investigations, Agronomy, July to September, 1954.

Mechanisation. Half-Yearly Report, April to September, 1954.

Notes on Extension Work, July to September, 1954.

DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA.
Kuala Lumpur.

PRICE $2

DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA.

ORGANIZATION (as at 31st November, 1954).

Director of Agriculture:—O. J. Voelcker, C.B.E., M.A., A.I.C.T.A.

Deputy Director of Agriculture:—R. G. Heath, B.Sc. (Agr.), A.I.C.T.A.

Administrative Officer:—H. F. Logan. (*On leave*).

Office Assistant:—Low Kim Ann

Financial Assistant:—V. Sundram.

RESEARCH BRANCH.

Chief Research Officer:—
R. B. Jagoe, B.Sc. (Hons.).

(II) BOTANY.

Senior Botanist:—
L. N. H. Larter, B.Sc. (Hons.), A.R.C.S., A.I.C.T.A.

(BOTANISTS):

Plant Breeders:—
F. B. Brown, B.Sc. (Hons.), Dip. Agr. Sci. (Camb.). (*On leave*).
A. V. Haddon, B.Sc. (Hons.), Dip. Agr. Sci. (Camb.).
Chew Hong Jung, B.Sc. (Hons.), B. Agric.
Van Thean Kee, B.Sc. (Hons.).
*W. F. Grant, M.A., Ph.D.
Mrs. B. Chapman, B.A. (Hons.) (Camb.), (*Temporary*).

Plant Physiologists:—
J. Dore, B.Sc. (Hons.), Ph.D., A.R.C.S,
*R. G. Lockard, B.S.A., M.Sc. (Agric.).

Asst. Research Officer:—
Tak bin Haji Daud.

(III) CHEMISTRY.

Senior Chemist:—
A. E. Billington, M.A., A.R.I.C.

Canning Officer:—
(*Vacant*).

Chemists:—
G. Youatt, B.Sc. (Hons.), Ph.D.
Miss M. Smith, B.Sc. (*Temporary*).
One vacancy.

Assistant Chemist:—
K. Kanapathy, B.Sc. (Hons.) (Madras). (*At present on Scholarship Course*).
Kao Wei Tsan, B.Sc. (Lingnan).

(IV) SOIL SCIENCE.

Senior Chemist (Soils):—(*Vacant*).
J. K. Coulter, (*Acting*).

Chemists (Soils):—
J. K. Coulter, B.Sc. (Hons.), B. Agr., Dip. Agr. Sci. (Camb.), A.R.I.C.
A. R. McWalter, B.Sc. (Hons.).
G. W. Arnott, B.Sc. (Hons.), D.T.A.
One vacancy.

Geologist (Soil Survey):—
W. P. Panton, B.Sc. (Hons.), D.T.A.

Asst. Research Officer:—
Haji Abdul Wahid bin H. Jaffar.

(V) ENTOMOLOGY.

Senior Entomologist:—
H. T. Pagden, M.A., F.R.E.S. (*On leave*).
R. J. A. W. Lever. (*Acting*).

Entomologists:—
R. J. A. W. Lever, B.Sc. (Hons.) (Dunelm), D.I.C. (Lond.), A.I.C.T.A., F.L.S.
I. J. Wyatt, B.Sc. (Hons.), D.T.A.

Asst. Research Officer:—
Kamardin bin Bahar.

FIELD BRANCH.

Chief Field Officer:—
J. R. Curry, Dip. Agr. Sci. (Dunelm), N.D.A.

Agricultural Economist:—
T. B. Wilson, B.A. (Oxon), Dip. Agric. Econ. D.T.A.

Personal Assistant to Chief Field Officer:—
Yoon Weng Kong.

KEDAH & PERLIS: *State Agricultural Officer (Kedah and Perlis)*:—
E. J. H. Berwick, M.A., Dip. Agric. Sci. (Camb.), A.I.C.T.A.

Agricultural Officer:—
J. L. B. Hitchcock, B.Sc. (Dunelm).

Agricultural Development Officer:—
J. A. Cox, A.M.I.B.A.E. (*On leave*).

Asst. Agricultural Officers:—
H. Mohd. Salleh bin Musa.
Salim bin Mhd. Akib.
Abdul Hamid bin Haji Hussain (*Perlis*).

KELANTAN: *State Agricultural Officer*:—
R. Henderson, M.C., B.Sc. (*Acting*).

Asst. Agricultural Officer:—
Mahmud bin Haji Yaacob.

TRENGGANU: *State Agricultural Officer*:—
A. L. Barcroft, B.Sc.

Asst. Agricultural Officer:—
Ja'afar bin Mampak, O.B.E. (*On leave prior to retirement*).

PENANG & PROVINCE WELLESLEY: *Settlement Agricultural Officer*:—
J. R. Milburn, B.Sc. (Dunelm), D.T.A. (Trin).

Asst. Agricultural Officer:—(*Vacant*).

PERAK: *State Agricultural Officer*:—
H. J. Simpson, P.J.K., B.Sc. (Agr.), Dip. Agri. (Wye).

Agricultural Officers:—
Perak North—(*Vacant*).
Ismail bin Haji Md. Salleh (*Asst. A.O.*)
Perak Central—
L. A. Vivian, B.Sc., Dip. Agr. (Camb.), D.T.A.
Perak South—
T. R. Dickinson, B.Sc. (Agric.), Dip. Agr. (Camb.), D.T.A. (Trin.).

Asst. Agricultural Officers:—
Ramly bin Haji Tahir.
Ismail bin Hj. Md. Salleh.

SELANGOR: *State Agricultural Officer*:—
P. A. Gething, M.A., Dip. Agri. Sci. (Camb.), A.I.C.T.A.

Agricultural Officer Coast (North):—
B. C. Balbernie, B.Sc. (Agric.), D.T.A.

Asst. Agricultural Officer:—
Zakaria bin Abdul Rauf.

PAHANG: *State Agricultural Officer*:—
H. M. James, M.C., Dip. Agri. (I.C.T.A.)

Asst. Agricultural Officer:—
Pahang North—Othman bin Mohd. Lela.
Pahang East—
Wan Abdul Aziz bin Ungku Haji Abdullah.
Pahang South—Ahmad bin Jamal.

* Supernumerary appointments under the Colombo Plan.

(Continued.)

THE
Malayan Agricultural Journal

Edited by the Publications Officer with the assistance of
The Publications Committee.

Vol. XXXVII **No. 4, 1954.**

ERRATA, Vol. 37, No. 3

EDITORIAL 201

ORIGINAL ARTICLES.

CACAO PROPAGATION IN MALAYA WITH SPECIAL REFERENCE TO CACAO NURSERY TECHNIQUE BY C. Whitehead, B.SC. (Hort.), D.T.A. 203

THE MARKETING OF DURIAN FRUIT FROM PARIT DISTRICT, PERAK BY T. B. Wilson, B.A. (Oxon.), DIP. AGRIC. ECON., D.T.A. 211

THE DEVELOPMENT AND DESIGN OF A HAGOTAN FOR THE EXTRACTION OF MANILA HEMP FIBRE BY D. S. Boyce, B.SC. (Agric.) (McGill), M.SC. (Dunelm), ASST. M.A.S.A.E. 218

NOTES ON CURRENT INVESTIGATIONS, RESEARCH, JULY TO SEPTEMBER, 1954 225

NOTES ON CURRENT INVESTIGATIONS, AGRONOMY, JULY TO SEPTEMBER, 1954 233

MECHANISATION. HALF-YEARLY REPORT, APRIL TO SEPTEMBER, 1954 238

NOTES ON EXTENSION WORK, JULY TO SEPTEMBER, 1954 246

DEPARTMENTAL.

GENERAL NOTES 251

DEPARTMENTAL NOTES 254

STATISTICAL.

MARKET PRICES, JULY TO SEPTEMBER, 1954 255

PRODUCTION OF PALM OIL AND KERNELS, FEDERATION OF MALAYA 257

MALAYAN AGRICULTURAL EXPORTS, APRIL TO JUNE, 1954 257

RUBBER PRODUCTION, FEDERATION OF MALAYA 258

COPRA, COCONUT OIL AND COPRA CAKE PRODUCTION, FEDERATION OF MALAYA 259

PADI STATISTICS, FEDERATION OF MALAYA 260

COMMITTEES OF THE DEPARTMENT

The Advisory Committee.

The Hon'ble The Member for Natural Resources. (*Chairman*).
The Director of Agriculture, Federation of Malaya.
The Hon'ble The Financial Secretary, Federation of Malaya.
The Director of Forestry, Federation of Malaya.
The Director, Drainage & Irrigation Department, Federation of Malaya.
The Director of Veterinary Services, Federation of Malaya.
The Commissioner for Co-operative Development, Federation of Malaya.
The Director, Rubber Research Institute of Malaya, Kuala Lumpur.
The President, United Planting Association of Malaya, Kuala Lumpur.
The Hon'ble Col. H. S. Lee, C.B.E., J.P., M.L.C.
Mr. A. C. Smith, Kuala Lumpur.
Mr. P. A. Rogers, M.A., Kuala Lumpur.
Tuan Sheikh Ahmad bin Sheikh Mustapha.
The Deputy Director of Agriculture, Federation of Malaya.
The Chief Research Officer.
The Chief Field Officer.
The Administrative Officer. (*Secretary*).

Standing Committee on Investigations.

The Deputy Director of Agriculture. (*Chairman*).
The Chief Research Officer.
The Chief Field Officer.
The Senior Agronomist.
The State Agricultural Officer, Selangor.
The Agronomist-in-Charge, Federal Experiment Station, Serdang.
The Publications Officer. (*Secretary*).

The Publications Committee.

The Director of Agriculture, Federation of Malaya. (*Chairman*).
The Deputy Director of Agriculture.
The Chief Field Officer.
The Chief Research Officer.
The Senior Agronomist.
The Publications Officer. (*Secretary*).

Appointments and Promotions Board.

The Deputy Director of Agriculture. (*Chairman*).
The Chief Field Officer.
The Chief Research Officer.
The Senior Agronomist.
The Principal, College of Agriculture, Malaya.
The Administrative Officer. (*Secretary*).

Examinations Board.

The Deputy Director of Agriculture. (*Chairman*).
The Chief Field Officer.
The Chief Research Officer.
The Senior Agronomist.
The Principal, College of Agriculture, Malaya.

The Advisory Council, College of Agriculture, Malaya.

The Director of Agriculture, Federation of Malaya. (*Chairman*).
The Director, Rubber Research Institute of Malaya, Kuala Lumpur.
The Principal, Sultan Idris Training College, Tanjong Malim.
The Principal, College of Agriculture, Malaya.
The Director, Veterinary Services, Federation of Malaya.
The President, United Planting Association of Malaya.
The President of the Malayan Estate Owners Association.
Dato Abdul Razak bin Dato Hussein, Kuala Lumpur.
Mr. P. A. Rogers, M.A., Kuala Lumpur.
Secretary of the Alumni Association, College of Agriculture, Malaya.
The Commissioner for Co-operative Development, Federation of Malaya.
The Registrar and Bursar. (*Secretary*).

THE

Malayan Agricultural Journal

Vol. 37, No. 4, 1954.

EDITORIAL

Cacao Propagation. The methods adopted to propagate cacao in Malaya are described by Mr. Whitehead of the Agronomy Branch, stationed at the Federal Experiment Station, Serdang. The article reviews the postwar history of cacao introductions and proceeds to show the special advantages of the true-breeding Amelonado type. Although production of seedlings, either in propagation beds or directly into containers, is more expensive than sowing seed at stake, it has so far been found to be the better method for local use. Details of the various aspects of nursery technique are dealt with including a new type of container consisting of a wooden veneer tube. The author has been able to study conditions of cacao propagation at the Federal Experiment Station, Jerangau, Trengganu, as well as at Serdang, resulting in a full account of all aspects of the subject.

The Hagotan for Extracting Manila Hemp Fibre. The Manila hemp of commerce is extracted from groups of small fibres in the surface layer of the composite leaf-sheath. The apparatus required, as distinct from automatic machinery, is a mechanical extractor called a Hagotan and this forms the subject of Mr. Boyce's article. The fibre-extracting unit is described in detail and also illustrated and the difference between hand and power-operated types is also described. It is a matter of interest that the spindle constructed at the workshop at the Federal Experiment Station of *merbau* timber proved quite satisfactory. Certain improvements in design are suggested including a tractor-mounted Hagotan which could carry fibre to the factory in place of the more bulky portions of the pseudostems.

The Marketing of Durian Fruit. Another interesting article is that on the marketing of durian fruit in the Parit District of Perak which has been studied by the Agricultural Economist. The organisation and functioning of the market are described, from which it is shown that for about a month during one of the two peak seasons the daily trade in durians in Parit reaches the surprisingly high figure of $15,000. Transport is by river launch (with diesel engines), by sampans for short distances, by bicycles carrying about 60 fruits

weighing up to 150 lbs., by taxis each averaging about 140 fruits and lastly by lorries (each carrying 3,500 fruits) which are used for long distance transport. Prices and marketing costs are also dealt with, Mr. Wilson showing that relatively more of the advantages of grading accrues to the retail dealers than to the growers—a familiar enough picture elsewhere.

CACAO PROPAGATION IN MALAYA WITH SPECIAL REFERENCE TO CACAO NURSERY TECHNIQUE

BY

C. WHITEHEAD,

Agronomist.

Introduction.

Cacao can be conveniently divided into three mains groups; (i) Criollo, (ii) Trinitario and other heterozygous strains and (iii) Amelonado. Criollo and Amelonado are relatively homozygous and may be satisfactorily propagated from seed, whereas Trinitario and other heterozygous types must be propagated vegetatively if any degree of uniformity is to be attained.

Rosenquist (9) has outlined the history of cacao importations into Malaya and has described the programme of breeding and selection work being carried out. Emphasis is laid on the purpose of producing a satisfactory high yielding Trinitario clone. However he points out in a later paper ((10) Rosenquist and Sockalingam) that up to the present Amelonado imported from West Africa is superior to any available Trinitario material and is likely to remain so for some time to come. Amelonado is thus the variety of cacao which is at present recommended for commercial planting in Malaya.

Methods of Propagation.

Cacao can be propagated successfully by seed and a variety of vegetative means. The latter methods however are the more difficult and have therefore received more detailed attention and publicity. Keeping (6) described the techniques involved and refers in particular to the early work of Pyke (8) who was responsible for the development of investigations on the rooting of cuttings. This technique is now of primary importance in the vegetative propagation of cacao and has since been elaborated and adequately described by Evans (3) working in Trinidad.

The proposed utilization of Amelonado cacao in Malaya, however, has aroused interest in methods of propagating by seed. This method of propagation, while superficially appearing to require little need of elaboration does nevertheless provide many problems not the least of which is the lack of standardization of technique.

Propagation of Cacao by Seed.

Cacao is usually established in the field either by sowing seed at stake or by raising plants in nurseries and then transferring them to the field by one of a number of possible techniques. Hartley (5) has

inferred that all the chief cacao-growing countries prefer to adopt some method of nursery production and certainly in Malaya investigations to date with seed sown at stake have been discouraging. Seed sown at stake frequently suffers severely from damage by rodent pests and almost invariably appears less vigorous than that produced in nurseries. Nursery-raised plants have the advantage of better care and protection in what is essentially the most crucial stage of their development.

Production of Seedlings in a Nursery.

(A) Techniques.

A method in widespread use is that of germinating seed in propagation beds of sand or sand-soil mixtures and then transplanting into containers. The chief advantage of this method is that ungerminated beans and inferior seedlings can be discarded but it almost inevitably leads to some damage to the root system and a slight check in growth. It is furthermore an expensive method as transplanting seedlings is usually a costly operation.

Another and better method is the sowing of seed directly into containers. Failures or containers from which seedlings have been culled can be separated and re-sown quite cheaply, while developing seedlings are never checked in their growth. The technique, however, is still expensive and it has been estimated by Telfer (11) that the cost of producing planting material in Malaya can represent approximately one third of the total outlay in both the establishment of the crop on virgin jungle land and its subsequent maintenance for three years. It is thus of considerable importance that attempts be made to reduce this expense. Investigations into means of reducing costs with present techniques are meeting with some success. It appears that the expensive traditional plant basket might be replaced by the cheaper wood veneer tube which can be used several times. The possibility of dispensing with the use of containers altogether is also the subject of investigation and the technique, referred to by Berwick (1), of transplanting seedlings from a nursery seed bed direct to the field is now receiving increasing attention. This technique if it proves practicable under Malayan conditions will reduce costs substantially, but questions of technique and optimum climatic conditions will have to be answered before the method can be recommended and this is likely to take some time.

(B) Selection of Nursery Site.

This is a most important factor no matter what techniques are involved. In practice one often cannot be too idealistic but certain considerations must be taken into account if reasonable results are to be attained.

The site should be selected near the centre of the area it serves. It must have a suitable, reliable source of water and reasonable access in the form of roads to both sources of supply and distribution. In addi-

tion to these minimum essentials it is advisable to have the site situated in an open or lightly shaded area, flat or gently sloping, well drained, sheltered from the wind and protected from larger pests by a wire netting fence.

(C) Nursery Construction.

The construction of the nursery should be carefully planned. Shelters are best built in blocks separated one from the other by roads usually eight to ten feet wide. A headland of the same size should be left around the perimeter to allow the passage of vehicles. The perimeter itself is marked by a small gauge, wire netting fence sunk six inches into the soil and standing four feet six inches or more above ground level. The source of water should be located as near the centre of the nursery as possible.

Shelters are usually constructed in rows rarely exceeding one hundred to one hundred and twenty feet in length, spaced approximately five feet apart and arranged in a north to south direction. A shelter consists of a simple wooden or bamboo framework approximately six feet six inches tall on the east side and four feet six inches tall on the west side. This framework supports a sloping, rain-proof, atap roof which projects about nine inches on either side to provide eaves beyond the supports which are spaced about five feet, six inches apart. This provides room for seven baskets of 7 to 8 in. diameter per row under the shelter. The spacing of the shelters and their orientation will depend in practice on shade conditions in the particular area. It has been shown in nursery trials at the Federal Experiment Station, Serdang, that the object should be to exclude about 75 per cent of the full sun-light while at the same time protecting the seedlings from rainfall, see Plates I to V. Satisfactory and indeed increased growth can be obtained with the exclusion of all but 15 per cent light but the plants tend to become slightly etiolated. Optimum light conditions in the nursery however are influenced by shade conditions in the area which is to receive the seedlings.

(D) Water Supply.

This, as previously stated, should be located towards the centre of the nursery. The water should be clean and its pH value should not fall below 6.0 if this is avoidable. It is advisable to install a small portable pump if the supply is static. The pump can be used to feed hose-pipes either directly or via a system of mains. This reduces watering costs substantially but will obviously be economical only where nursery production is likely to be on a reasonably large scale. The terminal hoses used for actual watering should not exceed 60 feet in length as this is the maximum length of pipe which can be conveniently controlled by one man and provides sufficient hose to water half the length of each shelter from the main roadways. The water should be delivered from the hose through a rose or a flanged spout in order to break the flow and avoid scouring of the compost in the baskets.

(E) CONTAINERS.

Plant baskets are the containers most frequently used. These should be of a good quality and of standard size as it may be necessary to hold plants in them for six months or even longer. It may be advisable, but not absolutely necessary, to dip the baskets in a copper napthenate mixture in order to increase their economic life. Proprietary brands of copper napthenate are available in the Federation and these should be diluted with kerosene before use to reduce the copper content to about 1.2 per cent. If stronger mixtures are used the basket will not rot away in the ground and would have to be removed before planting. After treatment they should be drained and kept for at least one week before use. It is the practice at Serdang to remove all baskets before planting since it has been found that slow rotting is frequently associated with retarded development of plants.

Cheaper alternatives to the plant basket have been tried but only one appears to be satisfactory. This is a tube consisting of a wood veneer 15 x 9 in. with the grain parallel to the 9-inch edge, held in tubular form by two wire strands. It has no bottom but is usually packed with coconut fibre to prevent the contents falling through. The wood veneer may be treated with a preservative as is the plant basket but with 3 per cent solution, as it can be used several times. It overcomes difficulties commonly encountered when planting out from baskets. These veneer tubes were developed at the Forest Research Institute, Kepong.

(F) COMPOST.

This should be as standard as is possible in the particular circumstances. The importance of preparation and standardization of composts is emphasised by Lawrence (7) in the United Kingdom and the same principles apply with cacao as with any other plants in this respect. The basic criteria involved are:—

(a) that the physical texture should be such that it consists of equal parts by volume of solid materials, air and water;
(b) that the desired nutrient content attained is capable of supplying nutrients when these are required.

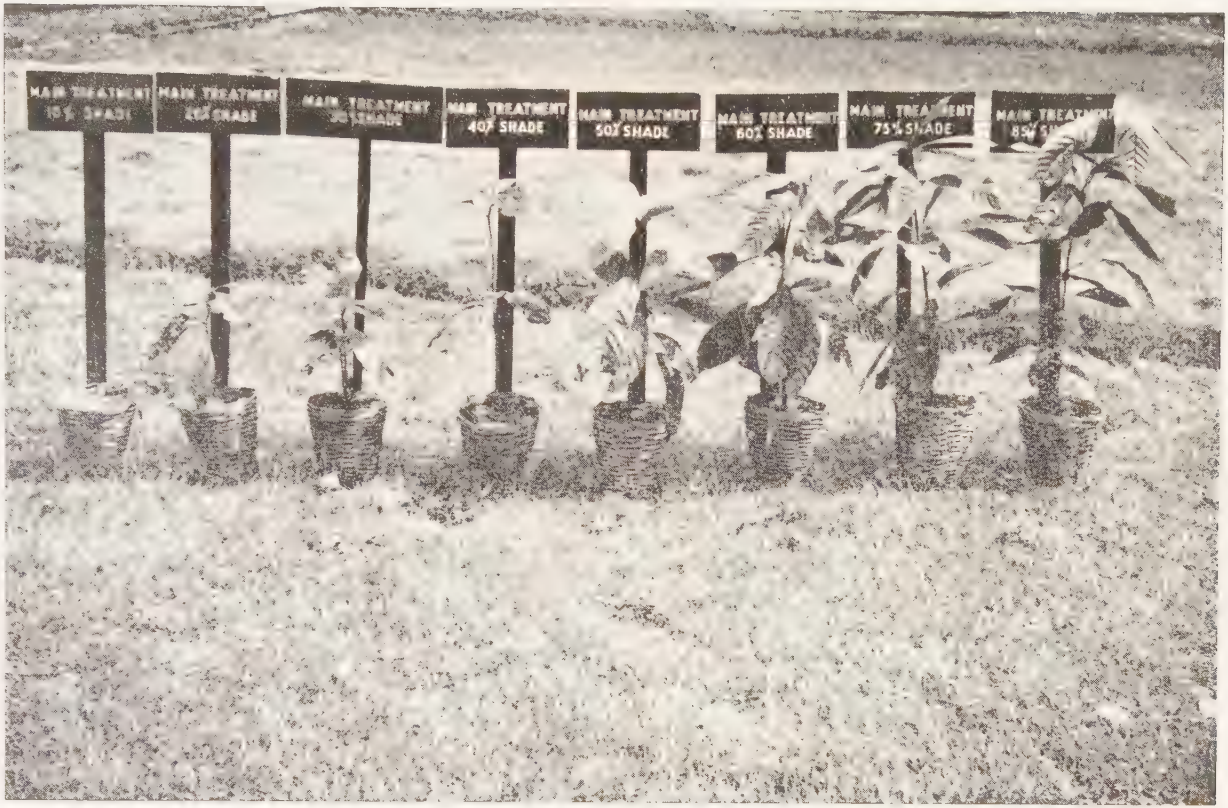
Absolute standardization, while desirable, is, as a rule, impracticable in new planting areas in Malaya. It has been found that the following compost has produced reasonably standardized growth of seedlings:—

(i) 7 parts of loam,
(ii) 3 parts of dried farm-yard manure,
(iii) 2 parts of sharp sand.

To this is added and mixed one ounce of double superphosphate per basket of compost. On no account should sulphate of ammonia, inorganic nitrates, or other caustic inorganics be mixed with the compost at the time of planting.

The loam used must be topsoil of a medium texture with a good crumb structure. It should be corrected if necessary to give a pH value of 5.5 to 6.0. The admixture of 6 lb. of finely ground limestone per

PLATE I.



Seedlings produced under various shade densities at Serdang.

PLATE II.

20% Shade.

PLATE III.

60% Shade.

PLATES II to V—Examples of cacao seedlings grown under four different shade treatments. Each treatment is sub-divided to provide sub-treatments with and without transparent shelters. Optimum shade treatment is considered to be 75 per cent shade; shelter from rainfall is an advantage at all shade densities.

PLATE IV.

75% Shade.

PLATE V.

85% Shade.

PLATE VI.

Cacao seedlings in a nursery in Malaya.

cubic yard of loam has been found to be satisfactory on some Malayan cacao soils. In some areas where soils are capable of retaining their crumb structure when regularly watered satisfactory results can be obtained, after correction of pH, from soil and phosphate alone. The farm-yard manure should be old and well rotted. The sand should be clean, sharp and free from clay, silt, lime and organic matter and should grade evenly from fine to coarse particles.

(G) Preparation.

The ingredients are usually mixed and stored in a potting shed. The loam and manure should be passed through a three-eighth-inch sieve to remove lumps and both should be in a good friable condition. Care should be taken to ensure thorough mixing and to accomplish this it is recommended that the loam should be spread on the floor in a layer a few inches deep followed by a similar layer of the manure on top and finally the sand. A little of the sand is withheld to dilute the superphosphate and this is finally spread evenly over the pile. The pile is cut down with a shovel and turned three or four times. The finished compost when squeezed in the hand, should form a ball which should not break unless tapped sharply with the forefinger. If the ball disintegrates, the compost is too dry whereas if it fails to break when struck it is probably too wet.

(H) Filling Containers.

To ensure even growth of seedlings the technique should be standardized to provide similar volumes and compaction of the compost in each. The container should have a pad of coconut fibre placed at the bottom to facilitate drainage but prevent loss of the contents. On no account should grass clippings be used for this purpose as they rot quickly and form an impervious layer. Compost is then added to overfill the baskets and the surplus struck off level with the top. The basket is lifted and tapped on the floor a specific number of times and the compost around the edge compacted gently but firmly with the finger tips. This will tend to force any water applied to the surface towards the centre of the basket where it is required. The surface of this compost is then levelled off and the container is ready to receive the seed.

(I) Seed.

The seed used should be taken from ripe pods. The transportation of cacao seed over long distances presents difficulties. Evans (2) has described the problems and methods of combating them. Within the Malay Peninsula, however, seed for commercial planting is usually transported in the pod. The seed is extracted by cutting almost through the pod wall horizontally and then breaking the pod open. Care must be taken during this operation to avoid cutting through the wall and into the beans. When the beans are removed from the placenta it will be noted that at the point of attachment there remains a small lump of

the seed stalk or funicle on the bean. This is important as it denotes the 'bottom' of the bean from which the radicle emerges, a factor connected with the orientation of seed at sowing.

The seed when extracted should be sown as soon as possible but it has been found that removal of the mucilaginous coating by rubbing in sand and then washing clean is an advantage as it reduces the incidence of ant attack which can sometimes severely retard growth of seedlings.

(J) Sowing Seed.

This operation is usually carried out in the potting shed subsequent to having filled the containers with compost. One seed, correctly orientated, i.e. with the funicle stump placed downwards, is pushed gently into the compost in the centre of the basket until the top is about half an inch below the soil level. The surface is then levelled and the baskets transported, usually in plant barrows, to the nursery shelters. The baskets are watered to settle the compost further and to saturate the manure which acts as a spongy reservoir providing moisture in a well aerated rooting medium.

Development and Management of Seedlings.

(A) Development.

D. W. Goodall (4) has shown that cacao seedlings have much slower relative growth and lower nett assimilation rates than seedlings of other species. He points out that the period of time which passes before the cacao seedling regains and surpasses the dry weight of the seed is very long. Thus it is four weeks after germination before the dry weight of the seedling exceeds that of the embryo at planting. The percentage weight of water reaches a maximum at this point also and thereafter declines. After sowing, the cotyledons absorb water and provide the greatest increase in water content for five days after which time the roots and later the plumule absorb larger quantities. The water content of the cotyledons continues to increase however up to three weeks after sowing and then starts to decline. The dry weight of the cotyledons, on the other hand, shows a steady decline after sowing until, at six weeks after emergence, it has lost 70 per cent of its original dry weight and abcission takes place soon afterwards.

This information while of value in itself also indicates the demands made by the seedling for nutrients. The first major demands for macro-nutrients from the growing medium appear in the third or fourth week after germination and steadily increase until at six or seven weeks one can assume that the growing medium is supplying all the necessary requirements. Demands for water, while varying in different parts of the plant at different times, can be assumed to increase gradually overall. The use of the correct compost, each ingredient of which plays an important role, makes management relatively easy.

(B) Management.

It has been shown in trials at the Federal Experiment Station, Serdang, involving the application of the same total quantity of water at differing intervals of time, that daily applications of about one pint of water per basket are advisable in dry weather. Care should be taken to avoid overwatering but the final decision on this point will have to depend on the nurseryman as the only absolute criterion is the condition of the compost itself.

Baskets containing seed which have failed to germinate 3 weeks after sowing should be replaced at the earliest possible date. For this purpose a section of the nursery is reserved for supply purposes. Basketed seedlings from this area, sown on the same dates as the area to be supplied are used to replace baskets with ungerminated seed which are in turn returned to the supply area and re-sown with fresh seed. It is advisable to adopt this practice to avoid producing plants of dissimilar age within the same area.

Seedlings are usually ready for planting out about four to five months after sowing, at a time when the plant carries no unhardened flush. During this time the only additional manuring normally required is a dressing of approximately one ounce of double superphosphate per basket usually applied about 12 weeks after sowing. If it should be necessary to hold plants in a nursery for a longer period it is advisable to top dress with approximately two ounces of a proprietary organic manure or if this is not available the same quantity of a mixture consisting of three parts of sulphate of ammonia, one part double superphosphate and one part sulphate of potash. The latter is best applied by mixing with a little of the same compost as a carrier and adding this to the top of the basket which has previously been well watered. In practice the mixture is made up in bulk and applied from a measured container.

If for some reason seedlings have to be established in areas with insufficient shade they should be hardened off before leaving the nursery. This can be done by gradual removal of portions of the atap shade before planting out.

Summary.

The historical aspects of cacao introductions to Malaya and present day position are briefly summarized. It is pointed out that Amelonado is the type of cacao selected for extension purposes and as this is relatively homozygous the usual method of propagation is by seed.

Production of seedlings in nurseries is shown to be more expensive than the technique of sowing seed at stake but has been found to be much superior under Malayan conditions. Investigations being carried out to improve existing nursery techniques and reduce costs are described and reference is made to work on other methods of nursery propagation. A description of the criteria involved in selection of site, layout and production methods is provided based on observations and investigations

carried out at the Federal Experiment Stations, Jerangau, Trengganu, and Serdang, Selangor.

References.

(1) BERWICK, E.J.H. (1950): "Further Investigations into the Growing of Cocoa in Malaya." *Malay. agric. J.*, **33**, 194.

(2) EVANS, H. (1950): "Results of some Experiments on the Preservation of Cacao Seed in Viable Condition". *Trop. Agriculture, Trin.* **27**, 48.

(3) EVANS, H. (1951): "Investigations on the Propagation of Cacao". *Trop. Agriculture, Trin.* **28**, 147.

(4) GOODALL, D.W. (1949): "A Quantitative Study of the Early Development of the Seedling of Cacao". (*Theobroma Cacao*) *Ann. Bot., Lond.* **13**, 1.

(5) HARTLEY, C.W.S. (1949): "Investigations into the Growing of Cocoa in Malaya". *Malay. agric. J.*, **32**, 59.

(6) KEEPING, G.S. (1950): "The Vegetative Propagation of Cocoa". *Malay. agric. J.*, **33**, 27.

(7) LAWRENCE, W.J.C. and NEWELL, J. (1948): "Seed and Potting Composts". Revised 3rd. Edit. (London).

(8) PYKE, E.E. (1931, 1932, 1933): Rep. Cacao Res. Trinidad.

(9) ROSENQUIST, E.A. (1950): "Cocoa Selection and Breeding in Malaya". *Malay. agric. J.*, **33**, 181.

(10) ROSENQUIST, E.A. and SOCKALINGAM, T. (1953): "Amelonado Cacao in Malaya". *Malay. agric. J.*, **36**, 164.

(11) TELFER, D. (1954): (Departmental correspondence).

THE MARKETING OF DURIAN FRUIT FROM PARIT DISTRICT, PERAK

BY

T. B. WILSON,

Agricultural Economist.

Introduction.

The durian predominates among the seasonal fruit of Malaya for the quantity, value and distance marketed. The fruits, widely sold in the towns of Malaya and Singapore, are produced in the *kampongs* (house lots) and *dusuns* (orchards) throughout the riverine, valley and foothill areas of the earlier Malay settlements. Customary rights of durian and firewood collection from the jungle and *tanah mati* (abandoned land) were recognised in the traditional land laws of most States.

The following information was collected from the District of Parit on the Perak River, where the main cash crop is smallholding rubber and padi is the main subsistence activity. Minor exports are fruits, mainly durians, and atap sheets for tin mine and new village roofing. Bukit Gantang, Batu Kurau and Telok Anson Districts of Perak also produce durians but export in much smaller quantities.

General.

Botanically the durian (*Durio zibethinus*) belongs to a small genus of trees of the family Bombacaceae found over a restricted part of Western Malaysia. Probably indigenous to Borneo, it now extends through Malaysia and the Philippines but is not in New Guinea or Burma proper. Its geographical distribution has been limited by the short period viability of the seeds.

The fruits hang singly like pendants from the underside of the main branches and are round or slightly ovoid, varying in size from 6 to 12 in. across and in weight from one to five lb. The thick skin is covered with short spines, hexagonal at their adjacent bases but narrowing at the top to strong sharp points so that the fruit is difficult to pick up if the stalk is broken. Cells may number from two to five and the seeds two to six covered by an edible pulpy aril, the amount and quality being subject to considerable variation. All colours of aril are found from white to pink but cream is thought to indicate the best flavour.

The appeal of the fruit lies in its definite odour and flavour; these differ considerably between different trees, areas and seasons and even fruits. The length of time since falling is one further factor in the complex flavour as chemical changes occur from the moment of falling

until the fruit is inedible. Only comparatively recently have budded durian fruit trees been available from the nurseries of the Department of Agriculture and most of the trees now in bearing are of unselected seedling material, whose fruits are of infinite variety.

Production.

The trees come into bearing at eight to ten years and in the same area will flower and fruit at either the main or the minor fruit season which follows six months later, each season lasting four to seven weeks. Yields of 200 to 300 fruit per tree are not uncommon, though the average per fully grown tree at 20 years is probably not more than half of this. Some trees are sterile and others which have been planted among strongly competitive rubber trees may have few fruits, thus the average yield per standing tree is probably not more than 100. Some trees now standing are known to be over 60 years old and they still continue to bear.

The fruits fall when ripe and the only harvesting necessary is to collect from the undergrowth which sometimes has previously been cut short. Fruits near the houses are collected through the night as they are heard to fall, and small temporary shelters may be erected among distant groups of trees as a precaution against predial larceny.

Most durian fruits from those trees which, by local knowledge and standards, are of the best flavour are retained by the grower to be eaten by friends and relatives. Malay women are skilled in making conserves, such as *tempoyak* (salted aril) and *lempok* (aril boiled with sugar). But the commercial value of the durian depends on the Chinese, whose acquired taste for the fresh fruit has created an appreciable market in practically every town in Malaya. However, a considerable proportion of the total production is retained in the kampong owing to the present organisation of the marketing system.

Marketing.

Only small amounts of the fruit are sold direct from producers to consumers at the roadside or in the village street, and the bulk of the crop passes through the hands of between three and five intermediaries. The first stage of marketing takes place early in the morning in the villages, where the tree owners sell to local dealers the fruit which fell during the night and the previous day. Occasionally, fruit may be sold on the tree to a dealer. These buyers, who bicycle along the village paths with large *raga* (baskets) may own durian trees, but usually are workers in rubber estates. The bicycle-buyer will either cycle to Parit town or resell to a larger dealer who collects up to 500 fruits at the many loading points along the river bank and relies on the river launches to provide transport to Parit.

Transport.

Durians are brought to Parit from as far as Lambor, 22 miles downstream, and from Choping Island, 10 miles upstream. Transport is

by launch, bicycle or sampan, and the numbers of fruits carried by each type were recorded for three days about the middle of the season (Table I).

Table I.

Quantities of Durians Transported to Parit.

Type of Transport.	Daily Quantity (Av. of 3 days).	Percentage.
River launches	18,710	39
Bicycles	26,800	57
Sampans	1,326	4
	46,836	100

The river launches carry in bulk and from the furthest distance. Ten diesel-engine boats normally ply between Lambor and Parit carrying passengers, bicycles and general stores, and one or two are used wholly for durians during the season. The load averages 1,000 to 1,500 fruit with passengers, and 3,000 to 5,000 without. The boats start from 7 a.m. onwards from Lambor, calling at Bota at 10 to 12 a.m. and arrive at Parit between 1 and 4 p.m. The launch is the slowest method of transport, especially when the river level is low and launches run aground on the shifting sandbanks. The fare is 2 cts. per fruit up to 11 miles and 3 cts. each between 11 and 22 miles; small ones counting half price.

Some 400 to 500 bicycles bring the fruit to Parit with 50 to 70 fruits in a basket behind the seat and four to five tied on to the handlebars (such a load weighing 100 to 150 lb.). Bicycle dealers come from as far as the village of Bota Kanan[1], 11 miles downstream, and arrive two hours later in Parit, in time to sell at the better prices prevailing in the earlier part of the day. From Bota Kiri[1] the bicycles go further upstream to the cheaper fare stages and wait for the launches to take them up to Parit on the opposite bank.

About 20 sampans near Parit provide short-distance transport (of one to three miles) from the opposite bank. Their loads range from 40 to 100 fruit and average about 70 per boat. The fare ranges from 1 to 3 cts. each according to the distance to Parit from Kampongs Blanja, Tua, Badang, Baharu and Sungei Korok. Transport from Parit is provided by bicycle, taxi and lorry. The bicycle has only a small range of up to 10 miles, e.g. to Siputeh village; the cyclist sometimes retailing the fruit and returning home at night to Parit.

The taxi extends the market to about 25 miles and fruit goes along the normal taxi routes from Parit to Ipoh, Batu Gajah, Pusing, Tg.

[1]: the Perak River villages are usually paired on opposite banks of the river; Kanan indicating a right bank village, and Kiri meaning left going upstream, the converse of the English custom.

Tualang and Sitiawan. The average load is 138 fruit (average of 32 taxis) with 60 to 150 in the boot, although the load can be increased to 200 or 250 by inside loading but this is thought to be illegal. The fare is between $3 and $4 per 100 fruit. Two or three durian sellers in Parit have their own cars, these are the larger rubber smallholders.

Long-distance transport is provided by lorry, usually carrying to Penang, Alor Star and the towns en route. These are hired at $180 for the day, and carry between 3,000 and 5,000 fruit (average 3,500 in 14 lorries). Some of the lorry drivers buy on commission for large dealers in Kedah. Other lorries passing through Parit may take durians as a secondary or return load, e.g. the Pangkor Island sea-fish lorries going to Ipoh from Lumut. On the three days when the type of transport used from Parit was recorded for some 60,000 fruit, 81 per cent left Parit by lorry, and the rest mainly by taxi.

Table II sets out the actual fares charged for different types of transport, converted into a flat mileage rate per fruit.

Table II.

Details of Fares Charged for Transporting Fruit.

Type of Transport.	Fare.	Distance (miles).	Average per Fruit per Mile (cts.)
Perak River Launch	(i) $2 per 100 (ii) $3 per 100	Below 11 11 to 22	0.4 0.2
Taxi (Parit—Ipoh)	$3.50 per 100	20	0.17
Lorry (Parit—Penang)	$180 per 3,500	100	0.05

Water transport is usually considerably cheaper than road haulage, although slower. The Perak River launches are, however, dearer than either taxi or lorry, though both launches and taxis carry passengers on the same journey. Taxi transport is an expensive method of goods transport, yet 8,000 to 10,000 fruits from Parit arrive daily in Ipoh in approximately 60 taxi loads.

The Retail Market in Ipoh.

The sellers in Ipoh number between 60 and 80 and group their "stalls" or heaps of durian fruit along the sides of the road at three or four main points. The majority are Malays and some come from Parit daily; the rest are Chinese, mainly living in Ipoh. Each stall contains about 150 fruits (157 average of 43 stalls), i.e., equivalent to a taxi-load.

The marketed fruits are roughly grouped on the basis of quality or of size into five grades in descending order of value:—

(i) "Selected" (i.e. from well known individual trees) which can be any size and may be sold under "branded" names,

e.g. "Durian Emas" near Ipoh and "Durian Rajah" near Parit.

(ii) "Large", (iii) "Medium", (iv) "Small".

(v) "Split" or "inferior" (i.e. those fruits attacked by borer or splitting owing to fermentation of the aril or to the impact of landing). Some varieties, e.g. the pointed fruit, are thought more vulnerable and readily split on falling; most have to be cut open.

The Malays mostly grade their fruits by size whilst the Chinese sellers usually sell the quality fruit from selected trees, and are more active at the beginning and end of the season, when supplies are short.

Prices.

Prices at all marketing stages from producer to customer show two trends: one a seasonal and the other a daily movement. Early and later in the season, the prices are naturally high: early in the afternoon the fruit is freshest and competition is strong to get the fruit to town quickly. Later in the day the prices stabilise from 3 p.m. until 8 or 9 p.m. Between 10 p.m. and midnight the prices fall quickly as sellers wish to return home, some of them by taxi to Parit. Rain will adversely affect prices since fewer people will be out buying; pay-days favourably affect the general price level in Ipoh.

Prices vary considerably in the river villages to some extent because of unreliable reports of prices prevailing in Parit and Ipoh where the markets, by contrast, are almost perfect: large numbers of sellers and buyers all with complete knowledge of market conditions.

The village prices in Table III are recorded for individual transactions—they are not averages and cannot be regarded as more than possible indications of the price pattern.

Table III.

Actual Village Prices Paid on Two Days for Fruit Graded by Size.

	28th January, 1954.			29th January, 1954.		
	Large	Medium	Small	Large	Medium	Small
	cents.			cents.		
UPSTREAM:						
Choping	22	20	18	22	21	18
Tg. Blanja	—	—	—	20	18	17
DOWNSTREAM:						
Kg. Sadang	—	—	—	24	20	18
Kg. Sg. Korok	—	—	—	24	20	18
Kg. Didalu	—	—	—	24	20	18
Layang Layang	20	18	15	19	16	15
Pendiat	25	20	15	—	—	—
Bota	25	21	20	22	20	15
Telok Kepaying	25	20	15	—	—	—
Telok Bakong	21	20	18	21	20	18
Kg. Tua	—	—	—	20	18	15
Lambor	—	—	—	—	—	—

The prices in Parit in Table IV were recorded for a total of 40 transactions, i.e. about 6,000 fruit destined for Ipoh, and daily averages were obtained. A system, *basikan sikit* (baker's dozen), is customary, whereby an extra fruit is added, e.g. at 30 cts. each durian, 11 and not 10 fruits will be sold for $3.

Table IV.

Average Prices per Fruit for Three Days in Parit.

Date (1954)	Total Price.	No. of Fruits.	Av. Price per Fruit.
26th January	$ 461	1,000	46 cts.
29th January	$ 665	2,025	32 cts.
31st January	$1,199	3,030	39 cts.

The Ipoh prices were recorded in greater detail and prices obtained from 46, 24 and 27 stalls respectively on the 26th, 29th and 31st January. The table below shows the relative prices for different grades, although the general level of prices obtained by the recorder is probably slightly higher than an actual buyer, with a little bargaining, might have obtained.

Table V.

Average Price in Cents per Fruit on Three Days in Ipoh.

(Four grades of fruit)

Date (1954)	Large	Medium	Small	Spoiled
26th January	67	45	27	18
29th January	76	54	38	20
31st January	68	46	28	18

Daily price variation in both Parit and Ipoh is considerable though the two price trends do not coincide. Ipoh prices do not follow Parit price movements although most of the Ipoh fruit comes from Parit. The bulk of Parit's trade however does not come to Ipoh and the influence of Penang and Kedah is probably greater.

Marketing Costs.

Waste at the retail stage is an appreciable cost in all fruit and vegetable marketing: some fruit is sold at clearance prices very late at night, but more costly is deterioration owing to fermentation, bad handling, or fruit borers. In a sample of over 3,000 fruit, about 13 per cent was wasted from all causes. The retailer and the middleman's margins are obviously affected by both this factor and the relative composition of their sales; i.e. their overall profit will be greater where a large proportion

of their fruits fall into the large size groups. The first village bicycle dealer makes about $3 to $5 per day (a morning's work but seasonal only) and the final Ipoh seller at least double this. The traders in quality-selected fruit are, of course, operating at higher prices, risking more capital and consequently making greater profit; their overhead labour and transport costs per day being relatively less per fruit sold. Relatively more of the advantages of grading accrue to the retail dealers than to the growers. The Ipoh retail prices for one day were distributed as follows between growers (28.3 percent), transportation (10.7 percent), wastage (4.4 percent) and marketing agents (56.6 per cent). This price breakdown obviously varies daily according to the different price trends at Parit and Ipoh, but transport and wastage will be inflexible costs.

Summary.

The organisation and functioning of the durian market in Parit are briefly described and mention is made of the agents, markets, transportation and price arrangements. The information is not claimed to be more than generally indicative, and its reliability varies over the different subjects studied, but the extent and importance of the durian fruit market are definite enough: the daily trade in durians from Parit alone is not less than $15,000 for at least four weeks of the durian season.

As with most tropical agricultural products, there is a wide margin between producer and consumer prices, this resulting from inefficiency in the systems of transportation and marketing.

Acknowledgements.

The writer wishes to thank Mr. H. J. Simpson, State Agricultural Officer, Perak, for providing the staff for three days to record this information during the middle of the main durian season of 1954.

THE DEVELOPMENT AND DESIGN OF A HAGOTAN FOR THE EXTRACTION OF MANILA HEMP FIBRE

BY

D. S. Boyce,

Agricultural Engineer.

Introduction.

Manila hemp or Abaca fibre is obtained from the leaf sheath of *Musa textilis*. All species of *Musa* including the several species and varieties of bananas contain usable fibre but only the fibre of *Musa textilis* is of sufficient strength to be a valuable article of commerce. Manila hemp is particularly useful on account of its resistance to the effects of sea water. As a cash crop with a ready demand if produced in quantity, it could make useful contribution to the diversification of Malayan agriculture.

Several varieties of Manila hemp have been grown experimentally by the Department of Agriculture for a number of years, and encouraging results have been obtained with one or two of these varieties. Successful experiments have also been carried out on some European managed estates and small scale commercial production has been achieved by a few.

In general, the moist Malayan climate is suitable for growth of Manila hemp, but a highly fertile soil is needed to obtain good results from vigorous growth. Rich soils of good texture, such as basic volcanic soils or suitable alluvium are best. Manila hemp must also be protected from high winds as the large leaves are easily damaged.

The fibres of commerce are extracted from the leaf sheaths composing the pseudostem of the plant. These fibres are aggregations of smaller fibres and occur in abundance in the sub-surface layer of each leaf-sheath. Only the coarse sub-surface fibres are normally extracted, but microscopic examination shows that the entire leaf-sheath section is permeated with very fine fibres, and if a commercial use for the latter were found, methods for their extraction could probably be devised.

The mechanical extraction of moderate quantities of the marketable Manila hemp fibre requires a certain amount of simple mechanical plant. It should be noted that there is available, a completely automatic Manila hemp extraction plant into which whole Manila hemp stems are fed and from which graded fibre is automatically produced. However, though this machine is reported to achieve high outputs and a high rate of extraction, its initial cost is prohibitive and, moreover, very large stocks of raw material must be available for economic operation. This type of plant will not be discussed further.

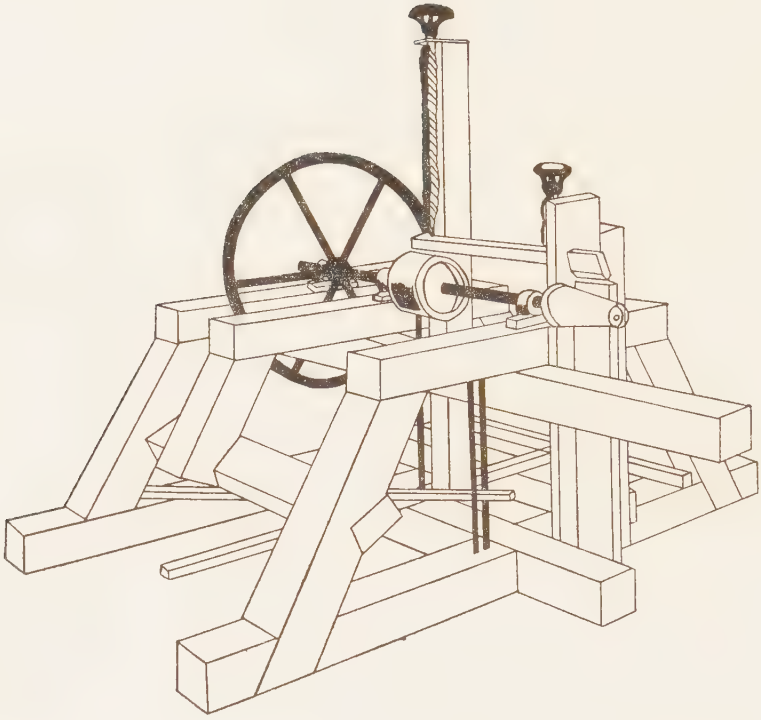
Terminology.

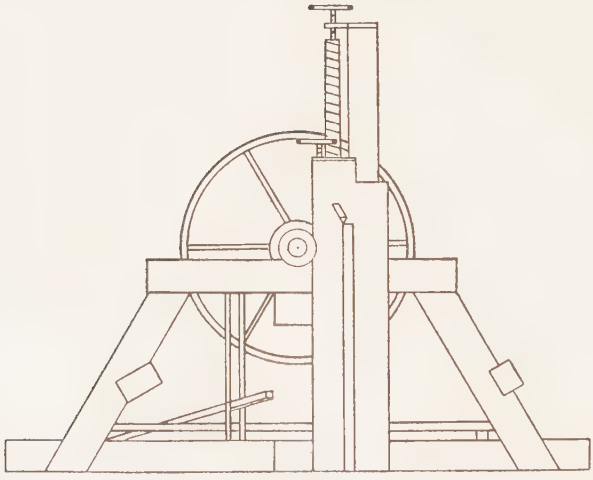
It will be convenient, before discussing the Hagotan in detail, to enumerate a number of terms particular to the Manila hemp industry. The stems (pseudostems) are cut down or tumbled with a sharpened spade-like, three-edged implement known as a tumbling bolo. After tumbling, the stems are trimmed (butted and topped) and transported to a central area or factory where they are tuxied. Tuxying implies stripping the stem into its component parts with a small, pointed, broad-bladed knife. Only the outer portion of each sheath, containing the valuable coarse fibres, is retained and the rest of the stem is discarded. As the tuxying operation proceeds towards the centre of the stem the tuxies become shorter. Tuxies usually vary in length from 6½ to 5½ ft. It is interesting to note that, though it is popularly believed that stems should be processed within 24 hours of harvesting, visual observations have indicated that there is no deterioration in the case of extraction or the quantity of the fibre from stems left unused for considerably longer periods; however, tuxies left for even a short time commenced to discolour and dry out rapidly, and both the ease of extraction and the resulting fibre were affected.

Manila hemp fibre can be extracted with either a hand or powered Hagotan. Both utilize an identical principle and the latter has been developed from the former. The stripping component of either unit is a spring-loaded, flat, smooth blade resting on a slightly elastic base block. In early machines the base block was of wood (2) but it has now been found more convenient to utilize a rubber base block held in place by a sheet metal component. Plate I shows a blade and base block on a powered machine. Work carried out in the Philippines (3) with serrated and plane stripping blades indicates that the plane blade produces less fibre of a higher quality while the serrated blade produces more fibre of a lower grade. All fibre extraction in this Department to date has been carried out with plane blades.

The stripping blade is ground to a smooth semi-circular cross-section and it is held against the base block by the action of an adjustable spring. In the powered Hagotan the arm carrying the blade is essentially a first class lever and is shown in Plate II. The fulcrum is so designed that it is adjustable vertically by means of a screw which allows the stripping blade to be raised or lowered and thus it can be levelled with respect to the base block and variations, brought about by changing spring loading or base block wear, can be compensated. The operational pressure exerted per inch of blade on the base block by the powered machine at Workshop and Pool was indirectly calculated to be 60 to 80 lb. per in. The blade section should be made detachable from the lever arm to facilitate regrinding or replacement of worn or damaged blades.

The arm carrying the blade is connected to a foot-pedal which releases the spring tension and separates the blade from the base block. This allows the tuxies to be inserted between these two components which are then closed by releasing the foot-pedal. A pull is then exerted on





FACTORY HAGOTAN

PLATE I.

The Stripping Component.

PLATE II.

The Blade Arm and Loading Spring.

the free end of the tuxies which are drawn between the blade and the base block. In this way, the fibre is removed from the adhering plant tissue. The fibre is then dried, in a location protected from direct sun's rays, sometimes brushed, and finally baled.

It should be noted that some fibre is always inadvertently discarded with the waste stem material. Such fibre under normal operation appears to be very fine. Occasionally however, when the tuxies become tangled, increased fibre losses are realized. This occurs most frequently when many narrow tuxies are being stripped or when they have been frequently handled; consequently, it is desirable to have wide, even tuxies, which have been handled infrequently. If the finished fibre is ragged and torn in appearance, it is probable that its tensile strength is lowered. Such fibre is also much more liable to tangle during stripping and subsequent handling. This occurs frequently when the stripping blade is not smooth. Should the blade pressure be excessive, some fibres will be broken or badly ruptured and the surviving fibres will be extracted only with the expenditure of excessive power; however, if the blade pressure is insufficient, all the plant tissue will not be removed from the fibre. The most common of these defects is the combination of an uneven blade exerting an excessive pressure, the resulting fibre sample showing crushing and aggregate fibres partially separated from their parent. Consequently, if a quality fibre is desired and a high extraction rate is to be achieved, the edge of the stripping blade must be as smooth as possible and the pressure exerted by the blade must be at a minimum consistent with producing a clean fibre.

The Application of Power.

The fibre-extracting unit of the Hagotan has been described above and the influential factors considered. The application of power to the tuxies to draw them from between the stripping blade and the base block must now be discussed. In the case of the hand-operated unit, the tuxies are placed between the blade and the base block and at the same time one end of the tuxies is wrapped round a wooden stick. Then each end of the stick is grasped by the operator and the tuxies are pulled between the stripping components. The tuxies are reversed and the procedure repeated, thus completing the stripping (1). One disadvantage of this method is that it is slow and laborious. However, hand stripping is worth considering for individual smallholdings, where it is desirable to reduce capital expenditure to a minimum.

The powered Hagotan has developed logically from the hand machine and the application of power has greatly increased the output of the operator. It differs essentially from its predecessor in that a rotating, tapered, wooden spindle is mounted in front of the stripping component. A number of tuxies are then placed in position between the stripping blade and the base block. The operator wraps the tuxies, loosely, two or three times round the revolving spindle retaining one end of the tuxies in his hand. A downward pull is then exerted on the portion

he has retained and the tuxies are pulled from between the stripping components by the frictional reaction between the tuxies and the spindle. The procedure is repeated with the tuxies reversed to complete the stripping.

The development of the power-operated Hagotan has introduced a number of additional considerations. Obviously, the most essential factor affecting output is the speed of the spindle. Initial work assumed that a mean linear spindle speed of about 210 ft. per min. (at 200 r.p.m. and working radius 2 in.) was desirable. This is the maximum speed obtainable from the line shafting in the factory at the Federal Experiment Station, Serdang. A second machine was built at Workshop and Pool with a spindle of identical dimensions and powered by a petrol engine capable of giving much higher spindle speeds. When this machine operated with a mean linear spindle speed of about 314 ft. per min. (300 r.p.m. approximately) production was increased by more than one-third. It is thus desirable to run a Hagotan stripper at the highest practicable speed. It was, however, found that at speeds in excess of 367 ft. per min. (350 r.p.m. approximately) the operator was unable to control the tuxies effectively.

It is of interest to ascertain the horse power required to operate a Hagotan. A rough measurement indicated that a force of about 120 to 140 lb. was required to pull the tuxies from between the stripping components. Therefore, the horse power requirements at the highest useful speeds varied from about 1.34 to 1.55 h.p.; however, as a large flywheel is incorporated in the system and blockages tend to reduce its speed, a 4½ h.p. engine was fitted to this Hagotan and the reserve of power proved useful in reducing fluctuations in the system.

It has been previously mentioned that from time to time the tuxies become tangled during stripping operations and that this condition could in fact be limited by careful preparation of the tuxies. A second factor which would contribute to tangling is characteristic of the tapered spindle. The spindle is tapered to facilitate the winding of tuxies on to it and removing the fibre from it; however, this taper causes the linear speed to vary from point to point along its length. Consequently, different portions of the same tuxy will be attempting to travel at different speeds thus causing twisting of the individual tuxies and contributing to tangling and irregular operation. This undesirable characteristic would be minimized if the working section of the spindle was of constant diameter while the free end is left tapered for the purposes previously mentioned.

It is perhaps worth noting that the material from which the spindle is constructed will influence the force which the operator must exert on the tuxies. A material with a high coefficient of friction is desirable; however, it must be reasonably durable. The spindle on the Hagotan constructed by the Department was turned from *merbau* timber and is satisfactory.

It should be noted that a considerable length of the tuxy is required

to wrap round the spindle and also to provide a hand grip for the operator. Consequently, the minimum length of tuxy that can conveniently be stripped is limited; therefore, to utilize the shortest tuxies possible the spindle should be placed as close to the stripping components as possible. Secondly, in order to ensure that the maximum length of the tuxies is in contact with the spindle without exerting a vertical force on the stripping components, it is essential that the top of the spindle be tangential with the base block. Then, if the operator exerts a downward force on the tuxies this condition will be realized. This assumes an anti-clockwise rotation of the spindle at the free end and further assumes that it is more convenient for the operator to exert a downward pull.

The characteristics of the spindle have been briefly discussed but no consideration has been given to its height in relation to the ground. Some Hagotans are constructed with the spindle so low that the operator works in an uncomfortably crouched position and is unable to exert a strong downward pull. The spindle and stripping knife would probably be more convenient if located at a height of three to four ft. Such an arrangement indicates a higher overall machine but the machine would certainly be less tiring to operate and perhaps a higher output would be realized.

It was found necessary to fit a flywheel on the spindle shaft to eliminate violent speed fluctuation in the system. It was found by the Department that a flywheel weighing 35 to 40 lb. with a radius of gyration of 12 in. was adequate.

The basic components of a Hagotan have been considered, but should the operator become entangled in the rotating spindle it is essential that provision be made to disconnect it instantaneously from the flywheel. This can be accomplished by fitting a cam-operated friction clutch between the flywheel and the spindle with a control easily reached by the operator.

Future Developments.

The development and design of the Hagotan stripper has been briefly discussed and it appears that there is scope for certain improvements. Existing Hagotans are heavy machines suitable only for permanent or semi-permanent siting but discussions with local planters have revealed that, if a suitably modified Hagotan could be developed and fully mounted on a medium-powered wheeled tractor and driven from the power-take-off shaft, a considerable reduction in production costs would be realized.

At present, stems are usually tumbled in the field and carried to the end of the rows and then either carted to the factory, which seems undesirable, or tuxied centrally in the field and the tuxies subsequently transported to the factory. If a tractor-mounted Hagotan were available and if access to all sections of the plantation were possible there should be a considerable reduction in production costs provided sufficient work were available to justify purchasing a special tractor. Such equipment would effect a saving in labour and plant and, technically, there would be no difficulty in providing a mounted Hagotan unit. Power could be taken

from the power-take-off shaft to a conventional spindle through a reduction drive. The spindle could be separated from the driving member by a clutch while all other components would be similar to the standard Hagotan; a flywheel would be unnecessary. Provision could be made for transporting stripped fibre with the same tractor.

Summary.

(1) Manila hemp is considered a suitable cash crop to introduce to Malayan agriculture.

(2) The power Hagotan is a practical machine to deal with moderate quantities of Manila hemp.

(3) The essential component of both the hand and power operated Hagotan is a spring-loaded blade with a semi-circular section acting on a slightly elastic base block.

(4) Efficient Hagotan stripping is only possible with wide, even tuxies (5½—6½ ft. lengths of component parts of the pseudostem).

(5) The pressure exerted by the stripping blade on the base block must be the minimum consistent with the production of a clean high quality fibre.

(6) The power Hagotan was developed to increase the output of an operator. It is essentially similar to the hand machine but has a rotating, tapered, wooden spindle mounted in front of a conventional stripping component.

(7) To achieve maximum output from a Hagotan, it must be run at the highest speed consistent with practical operation.

(8) The tapered spindle has certain undesirable dynamic characteristics which would be overcome if the working portions of the spindle were of a constant diameter.

(9) In order to utilize the shortest tuxies possible, the spindle should be placed as close to the stripping components as possible.

(10) Present Hagotan spindles appear to be located too low for operational comfort. Less operating fatigue and higher output would probably be realized by raising the spindle and stripping component.

(11) The drive from the flywheel to the spindle should be through a friction clutch.

(12) A fully-mounted tractor Hagotan would, under certain conditions, reduce the processing costs of Manila hemp fibre.

References.

(1) Carag, A.T. (1952): "Comparison of Two Methods of Cleaning Abaca Fibres in the U.P. College of Agriculture". *The Philipp. Agric.*, **36**, 69.

(2) Marsh, T.D. (1947): "Manila Hemp (*Musa textilis*)". *Malay agric. J.*, **30**, 123.

(3) Torres, J.P. and Cruz, P.I. (1941): "Efficiency of Different Benito Knives for Stripping Abaca". *Philipp. J. Agric.*, **12**, 15.

NOTES ON CURRENT INVESTIGATIONS, RESEARCH

JULY TO SEPTEMBER, 1954

Padi.

Selection.

Statistical analysis of last season's experiments was completed by the end of the quarter but it has not yet been possible to scrutinise these results.

Transplanting of the current season's experiments has been completed successfully in most States. Stations in Selangor, Province Wellesley and a few stations in North Krian remain to be planted. Late rains, in some cases resulting in flooding, disrupted establishment of a number of experiments in Kedah and Perlis and at some stations over-aged seedlings had to be used.

Photosensitivity.

A further experiment in the padi cage has just been commenced to determine the growth stage at which photo-induction of the reproductive phase operates. It is expected that this and subsequent similar investigations will furnish information of value in the selection of non-photosensitive varieties and in determining the optimum time of planting of padi in the field.

Nutrient Requirements during Growth.

Work has started on the second series of analyses of padi plants during growth in typical padi fields.

Pot cultures of padi in the presence and absence of various major elements are also continuing. Simple deficiencies of certain elements such as magnesium and potash produce clear symptoms of diagnostic value but where more than one deficiency occur simultaneously, this method may not prove practicable for field diagnosis. Leaf injections methods to confirm diagnosis based on leaf symptoms are now being tried.

Water Movement Effects during Growth.

A preliminary experiment to study gross effects of various conditions of water movement on the growth of the padi plant was commenced towards the end of the quarter in the Kuala Lumpur padi cage by the Plant Physiologist. Technical troubles due to low water pressure etc., have arisen but the experiment is proceeding satisfactorily.

Pest Control.

Following reports of the successful use of Endrin (an isomer of Dieldrin) against stem-borers in Japan and Taiwan, and the Philippines,

a randomized block pot experiment was laid down to compare this insecticide with Dieldrin. So far the borer attack, mostly by *Sesamia inferens* Walk., has not been heavy. The concentrations used were ½ lb. active ingredient of each per acre and these amounts will be laid down in a small field test.

Cacao.

Selection and Breeding.

Selection of individual trees in imported Trinitario families has been commenced. A total of 4,292 pods were harvested and characters of some 2,800 pods have been analysed. Among trees which have yielded 15 or more pods, 33 have been selected either for outstanding yield with satisfactory pod quality or for outstanding pod quality and with yield passing a minimum standard.

No new plantings have been made, but a part of Field 45a at the Federal Experiment Station, Serdang, is being prepared to receive the Upper Amazon (Nanay) x Amelonado progeny.

Compatibility Testing.

An investigation into compatibility testing technique was completed and confirmed that pollination should be confined to young, freshly opened flowers. Nevertheless, a number of tests continued to be indeterminate and it will be necessary to retest more thoroughly certain trees selected as potential parents.

In consequence, routine compatibility testing of the selection stocks has been resumed; some 6,000 flowers were pollinated during the quarter and about half of the compatibility testing programme is now complete.

Fermentation.

Cocoa and chocolate prepared from West African Amelonado grown, fermented and dried at the Federal Experiment Station, Serdang, was made for exhibition purposes. The quality was generally pronounced good. A number of analyses were carried out, and a report is in preparation.

A trial microfermentation after the methods of De Witt has been completed. Just before this report the final taste test of roasted beans has shown the usual failure, namely lack of flavour. Further tests are being carried out along the lines of a recent paper published by workers at Messrs. Cadbury's laboratories.

Oil Palm.

Breeding Programme.

365 seedlings of Dumpy x Pisifera (WAIFOR) have been planted in nurseries at Federal Experiment Station, Jerangau. Nursery plants at Serdang include 509 Dumpy x Dumpy and 653 Dumpy x Pisifera (IRHO). Pending decision as to provision of land for future oil palm work, seedlings are being established in nurseries at Serdang.

Sex Ratio. Recording of the onset and duration of male and female phases of individual palms and progenies has been commenced to study variation in sex ratios.

Yield Correlation. Analysis of covariance of yield on girth and height of Elmina progenies in Fields 3a and 4 at Federal Experiment Station, Serdang, though not yet complete, suggests that within the Dumpy progeny correlations are not highly significant.

Pest Control.

Investigations into the outbreak of *Cremastopsyche pendula* Joannis, on a South Perak estate, showed that control of the bagworm followed a trial dusting with calcium arsenate from a power duster on the ground.

Coconut.

Breeding.

413 nuts have been reaped from 20 of the 37 selected trees at Port Swettenham; 83 nuts have germinated.

Pest Control.

Three small tests with Dieldrin, Aldrin and BHC sprayed into 20 lb. boxes of compost containing a total of 150 larvae of *Oryctes rhinoceros* L. indicated that Dieldrin (as a solution of 1/75 Dieldrex 15) was better than Aldrin (as 1/100 of Aldrex 2) and BHC 6.5 per cent gamma at 1/200 but the latter at 1/166 gave kills as high as the Dieldrex. Tests are being continued.

Tea.

Clonal Selection Rooting Trials.

Following initial success with an improved rooting medium, of sawdust and loam, root development of cuttings has not progressed, and it has been decided that the fault may lie with the parent bushes, which need manuring.

Pineapple.

Selection.

A second consignment totalling 7,597 slips of material for selection has been transferred from Jalan Kebun to Alor Bukit; these represent 1,366 clones.

Smooth Cayenne material imported from Australia is now in process of being transferred to Alor Bukit from Pulau Tekong.

Pest Control.

Field observations at Jalan Kebun demonstrated that mealy-bugs begin to leave the plants as soon as wilt symptoms appear and it seemed

that, as reported previously, much wilt usually attributed to mealybugs is not entirely due to this cause.

Chemical Analyses.

Chemical analyses have continued on the edible portion of ripe pineapples, with the following objects:

(i) The establishment of "normal" values for the chemical composition of the two major pineapple varieties.

(ii) An attempt to correlate the sugar/acid make-up of fruit with the concentration of certain "major elements", particularly potassium and phosphorus.

(iii) Simultaneously to assess the effects of manurial treatments on the structure and hence the quality of pineapples.

For these objects, ripe fruits have been harvested from two experiments at Jalan Kebun, namely SEL. 98 and SEL. 103. The former is a two variety, five level, potash treatment trial, the latter a more complex trial involving two phosphate treatments. Results from the latter are so far inconclusive, but the indications from SEL. 98 are of interest.

Manurial Experiment Results.

SEL. 98

Fruit: *Singapore Canning.*

Treatments	Total Sugar % Mean	Titratable Acidity % Mean	Total Ash % Mean	K_2O in Ash % Mean
200 lb. K_2O/acre/annum	13.5	0.75	0.39	58.8
150 „ „ „ „	12.5	0.83	0.41	51.4
100 „ „ „ „	10.75 *	0.53 *	0.32	42.1
50 „ „ „ „	11.3	0.71	0.35	36.75
Nil.	10.15	0.49	0.36	29.4

* 2 samples only.

Control samples were significantly lower in total sugars and acidity than all treatments. Total ash level is practically constant, but the potash content is approximately a linear function of rate of application.

Canning Research Station.

The examination of the first large field trial in canning stale fruit to test the development of off-flavours has been completed. The storage period was three months. The results were negative. Two cans with slight "paraffin" flavour were found, far too low an incidence for any conclusions to be made. The second trial is being held for a much longer

storage period to ensure the development of any incipient off-flavours that may be present.

Fruit examination has continued on the crop from the following field trials:—

(i) Continued growth on peat soils.
(ii) Varietal, spacing and manurial trials.
(iii) First harvests of the five groups of Smooth Cayenne ex Australia grown at Pulau Tekong.
(iv) A.N.A. Hormone trial.
(v) Bet-naphthoxy-acetic acid trials.

A total of 1,093 fruits were examined, and 487 cans laid down.

Pasture and Fodder.

Green Fodder.

Monthly analyses of Trial F.E.S. 126 (manurial on pasture with shade) have continued. A comprehensive series of duplications are in course of analysis to estimate sources of error in this type of work.

Hay Grass (Dichanthium caricosum).

Samples from Kedah, Kuala Lumpur and Serdang have been analysed for feed value when cut at "vigorous growth-pasture" stage and at flowering.

Vegetables and Food Crops.

Groundnut.

The 214 selections retained from the last generation were planted and were approaching maturity at the end of the quarter.

Pak Choy.

A previously unrecorded leaf disease of Pak Choy occurred in Province Wellesley. The plants were found to be affected by anthracnose, caused by a species of *Colletotrichum*. Imported Japanese varieties were more heavily attacked than a local variety.

Fibres.

Ramie.

A ninteenth harvest was reaped pending analysis of the results of the first eighteen crops.

Jute.

At the Federal Experiment Station, Kuala Lumpur, it was found that spraying with a copper oxychloride fungicide considerably reduced the incidence of stem canker, caused by *Colletotrichum capsici*. In the unsprayed plots, 55 per cent. of the plants were severly attacked and 34 per cent. slightly affected. Corresponding figures for the sprayed plots were 22 per cent. and 15 per cent.

Manila Hemp.

A newly recorded pest on this crop was *Odoiporus longicollis* (Oliv.) which damaged the top of the pseudostems in a Selangor plantation. This weevil, and *Cosmopolites sordidus* (Germ.) which was also present, is common on banana but attacks here are at or near the root-stock. Two predacious beetles, *Plaesius javanus* Er. and *Gauromia* sp., were present.

Fruits.

Durian.

A hitherto unrecorded disease of durian was investigated at Federal Experiment Station, Serdang. Symptoms were a rotting of the bark of the trunk and lower branches, the surface of which became dark purple in colour. A species of *Nectria* occurring abundantly on diseased parts appeared to be the cause of the trouble. This disease is very similar to the one previously seen on cacao, also associated with *Nectria* sp.

Spices.

Cloves.

The occurrence on clove trees, *Jambosa caryophylla* (Spreng) (= *Eugenia aromatica*) in Penang, of the fungus diseases *Valsa eugeniae* and *Cryptosporella eugeniae* has been confirmed. The wide occurrence of these diseases in Penang clove plantations appears to be encouraged by neglect of good cultivation and attacks by the clove tree borer beetles *Chelidonium brevicorne* and *Niraeus tricolor*.

Experiments on control of these borers were continued, and a comprehensive report by the Senior Entomologist is in process of preparation.

Soils Investigations.

PADI.

Soil Survey, Trans-Perak Area.

The soil survey of this area is nearly finished and about 3,300 soil samples have been analysed to date, since 1948. About 1,500 have been examined for available phosphate and potash. The analyses indicate that some of the soils are very high in available phosphate and potash.

Mapping of the distribution of peat and clay has been almost completed, and fairly extensive areas of peat are indicated, especially in the south central portion of the area.

Soil Survey, Briah Swamp.

The topographical and soil survey of the Briah Swamp has been finished. Mechanical analyses have been completed on all the samples, but chemical analyses have still to be carried out.

Soil Survey, Kuala Langat.

Late in September, work started on the survey of 60,000 acres in

the Kuala Langat Forest Reserve (North). A line, 4 miles long, in the northern part of the area, was examined and was found to consist entirely of peat over 5 feet in depth.

Water Movement in Soils.

Between 24th July and 31st August, a series of experiments were carried out at Tanjong Karang on the site of the proposed Soils/Water Relationship Station by the Soils Science Division. The object of the experiments was to determine the effectiveness of puddled clay cores in restricting lateral movement of sub-soil water, and also to obtain some information on the nature and magnitude of lateral water movement in the coastal alluvium at Tanjong Karang.

The results of these experiments suggest that the method used could be applied to a study of the seasonal variation in structure of alluvial soils in general.

From measurements of the rate of loss of water from a *petak* surrounded by a puddled clay core it was concluded that a puddled core 24" wide x 30" deep was effective in stopping lateral movement of sub-soil water.

"Penyakit Merah".

The experiment to determine the effect of lime and fertilisers on the developmnt of *penyakit merah* on 16 soil samples from areas in which the disease had occurred was continued.

Experiment with Padi in Tanks.

With the completion of the concrete tanks in the padi cage, two rows (10 tanks) have been filled with a good padi soil from Tanjong Karang. The soil from Tanjong Karang is taken as being representative of some of the best types of padi soil. One row of tanks was filled with soil from near Kendong in Negri Sembilan, as a representative of the inland valley alluvium, particularly those found in Negri Sembilan; three rows have been filled with highly sulphurous *gelam* soil from Tanjong Minyak, Malacca, and a fourth row filled with the deep sub-soil from this area which has a sulphur content of 3 to 4 per cent.

Padi Analyses.

The straw and grain from a 3^3 N.P.K. manurial experiment with padi in sand culture have been analysed for ash, potassium, phosphorus, calcium and magnesium.

OTHER CROPS.

Soil Survey, Trengganu.

The Soil Surveyor started work in Trengganu on the 10th July. Topo sheets 2L/13 and 14 have been chosen for survey, as the areas covered by these sheets are known to contain some promising soils. Up to the end of August, about 200 sq. miles had been covered by reconnaissance survey methods. The more promising associations will be

examined in greater detail so that their suitability for high fertility crops can be determined.

Soil Survey, Temerloh-Maran Road Area.

A member of the Soils Science Division accompanied a Geologist of the Geological Survey Department on a 3 week survey of the region of the Sungei Jengka, in the Jerantut-Maran-Temerloh triangle, to get some idea of the extent of the andesite soils which are exposed on the new Temerloh-Maran Road. The above area is unexplored geologically. Much more detailed survey will be necessary before the actual areas can be mapped out, but it is probable that there are several thousand acres of good soils in the area, some of which occur in quite large blocks.

Deficiency Area, Kelantan.

A brief reconnaissance of this area was carried out, and this revealed the great diversity and extreme poverty of some of the soils.

Cacao Leaf Analyses.

Since analyses of cacao leaves will be required in the future for diagnostic and manurial advisory purposes, a start has been made on analyses of leaves from healthy well grown plants at Federal Experiment Station, Serdang. The analyses showed that the tips of the fans from the second jorquette had the highest plant nutrient content while the lowest was in the base of the fan.

Rambutan Leaf Analyses.

Leaf analyses of "scorched" leaves of rambutan in Penang showed a very high calcium and low potassium content. The soil potassium was also exceptionally low.

Reorganisation of Soils Science Laboratory.

The tremendous increase in the number of analyses with which the laboratory has dealt has been due in part to an increase in staff and the use of instruments, particularly the flame photometer, but is due in greater part to reorganisation of methods of analyses.

The methods of analyses used in the laboratory are being written up as part of a monograph on soil survey, identification of soil types, methods of sampling, methods of analyses and interpretation of analyses as applied to Malayan conditions.

Miscellaneous Pests.

New Stored Product Pest.

Living adults and larvae of the khapra beetle, *Trogoderma granarium* Everts., which has caused much damage to stored cereals and legumes in other countries, were found in a stack of 17 month old Burma rice in a Selangor rice store.

NOTES ON CURRENT INVESTIGATIONS, AGRONOMY

JULY TO SEPTEMBER, 1954

Padi.

Seven papers on the results of wet padi manurial experiments in Malaya were prepared for the October meeting of the Working Party on Fertilizers and the International Rice Commission of F.A.O. These papers will later be published in greater detail in this Journal.

Trials with different types of nitrogenous fertilisers have shown that sulphate of ammonia is almost always superior to nitrate of soda but that "ammophos" mixtures based on mono-ammonium phosphate and sulphate of ammonia show no superiority over equivalent standard mixtures of sulphate of ammonia and superphosphate. Placement of nitrogenous fertilisers about 4 in. below the surface has not shown the superiority over surface broadcasting that has been noted in India, Japan and some other countries.

Small applications of calcium salts may sometimes be beneficial in the absence of N.P.K. fertilisers and this effect, observed at two localities, is ascribed to the growth stimulation of blue-green algae and the consequent increase in nitrogen available to the padi crop. Somewhat naturally this beneficial effect of calcium has not been noted in the presence of N.P.K. fertilisers and magnesium has led to no regular response although it may sometimes be beneficial.

Trials with different types of phosphatic fertilisers are of great importance to Malaya since the cost of water soluble P_2O_5 is 282 per cent of the cost of the insoluble form as Christmas Island rock phosphate, while bat guano may sometimes be even cheaper. One series of 15 trials continued for 3 years has shown that the response to phosphate was general at 10 localities and that the soluble form was superior in about half these localities. This result has been followed up by 200 4-plot trials on cultivators' fields in which a dressing of 50 lb. per acre of soluble P_2O_5 (double superphosphate) was compared, in the presence of nitrogen, with a dressing of 100 lb. per acre of two forms of insoluble P_2O_5. Responses were very similar showing that it pays the cultivators to use the insoluble fertilisers, i.e. rock phosphate or bat guano, at these localities. It should be noted, however, that it is only in Kedah and Perlis that high grade bat guano is available at reasonable prices.

Nursery manuring has also been studied in two series of trials, one of which is still in progress. The application of 2 lb. of mono-ammonium phosphate per gallon of seed to the nursery resulted in mean positive yield responses at nine localities of from 100 to 779 lb. of grain per acre with a maximum response for one year of 1,321 lb. per acre. Pre-soaking seeds in solution of potassium or mono-ammonium phosphates may sometimes also lead to large responses in yield but, where these

occur, a beneficial effect can also be obtained by applying phosphatic fertilisers to the nursery beds.

Preparations for the new season are well in hand and in most areas nurseries are healthy. However, intermittent periods of flooding and drought have been recorded from Perlis which will make late planting inevitable. At Kahang, in Johore, heavy damage has been caused by stem borers, the black padi bug and *Nymphula depunctalis*.

A new padi station has been established at Gelugor, Trengganu, where one manurial experiment is being laid down. The remaining 8 acres of the station are being planted as a uniformity trial.

At Telok Chengai, Kedah, 7 acres have been cultivated mechanically and were subsequently sown with germinated seed using a fiddle. An experiment to test five different herbicides at three different dosage rates has been superimposed on this area which will be used for combine trials at next harvest.

Cacao.

Growth of young seedlings in a seed at stake experiment at Serdang has been somewhat disappointing. Initial growth was better where the mucilage was removed from the seed than where it was left on. Recently, marginal and interveinal leaf scorch has become evident in several fields, these symptoms being similar to those ascribed to phosphate deficiency in Trengganu. Remedial applications of phosphate and lime have been given but it is still too soon to expect results.

At the Federal Experiment Station, Jerangau, Trengganu, growth of West African Amelonado cacao continues to be good, both under thinned jungle and regenerating secondary growth. Provided that the young cacao plants are growing vigorously, extra overhead light which results from wind damage to the forest canopy seems not to be harmful.

It is now standard practice at Jerangau to apply ½ oz. each of double superphosphate and ground limestone to the basket compost and, since the inception of this practice, not one case of leaf scorch has been observed.

A site has been prepared for a lime-phosphate factorial experiment at Jerangau and preparations for a nursery technique trial are also in hand.

Durability trials of "whalehide" and other types of paper pots and of wooden veneer tubes are in progress at both Serdang and Jerangau. At the former locality it was found that all types of paper pots disintegrated after 4 to 12 weeks so they are quite unsatisfactory under local conditions. Treated bamboo baskets will last for at least one year while veneer tubes appear to be quite satisfactory although they need more careful handling than baskets.

Coconuts.

In a manurial trial, situated on infertile coastal sand, in Trengganu, the first application of fertilisers was made in August after recording pre-treatment yields for one year.

Oil Palms.

In a variety trial, which was planted at the Federal Experiment Station, Jerangau, in November, 1952, growth has been very good and 94 per cent of the palms are now bearing flowers or fruit bunches.

Fibres.

The first round of harvesting has been carried out on a Manila hemp variety trial which was planted at Sg. Ruan, Pahang, in 1952.

A portable Hagotan stripper, which was made for the State Agricultural Officer, Pahang, was shown in operation at the Malayan Agri-Horticultural Association Exhibition and at the Temerloh Agricultural Show.

Selections have been made from a seedling population of *Phormium tenax*, New Zealand flax, which is growing at the Federal Experiment Station, Cameron Highlands, and 166 seedlings have been planted out on a suitable piece of swampy land. Subsequent growth has been rapid. Good quality fibre has been prepared from sample leaves collected from the original plot.

Pineapples.

Observations at the Federal Experiment Station, Kuala Lumpur, have demonstrated that pineapples can be sprayed with very concentrated nutrient solutions made up from urea, mono-ammonium phosphate and potassium nitrate. Evening applications with a high-volume knapsack sprayer have had no harmful effect using solutions as concentrated as 40 per cent, but midday applications have been followed by some leaf scorch. When potassium chloride was substituted for potassium nitrate scorch resulted from considerably lower concentrations. The mechanism of this apparent immunity of pineapples to high-concentration scorch is not due to failure to absorb the solutions since a rapid and lasting colour-change was noted in Mauritius pineapples within 5 days of application. Since pineapple crops growing on peat are now normally sprayed regularly with copper solutions it seems likely that the use of combined nutrient sprays will lead to a considerable reduction in cost of production.

The question of partial mechanisation of field operations has been discussed with the State Agricultural Officers, Johore and Selangor, and with growers' representatives and it has been agreed that a prototype tractor-mounted field sprayer should be produced.

An Agronomist was posted to Klang in early September and he will concentrate on crop investigations on peat soils. It follows, therefore, that most of his time will be devoted to pineapple agronomy.

It has been observed that very closely spaced Singapore Canning pines (14,520 plants per acre) have turned yellow at Jalan Kebun and it appears that the fertiliser applications are inadequate for that particular spacing.

It has been noted at Alor Bukit that plants of Singapore Canning which have not been decrowned are particularly subject to lodging and

occasional stalk-breaking. This factor must be weighed against the proven disadvantages of decrowning.

Fruits.

Work at Serdang has shown that substantial improvements can be made in the technique of lifting and basketing budded fruit seedlings whereby these are lifted at scion budbreak instead of the traditional method of lifting at two stages when the scion growth is 1½ to 2 ft. tall. The new technique is as follows:—

(1) Stock beds are watered heavily two days before lifting.
(2) Plants are lifted in one operation, placed in a basket with coconut fibre below and then transferred to the potting shed.
(3) They are planted in a modified John Innes Potting Compost No. 3 wherein horticultural peat is replaced by coir dust.
(4) The stock is cut back to leave a snag 3 in. tall above the developing bud; the basket is immersed in water to settle roots and then placed under heavy shade in a plant shed.
(5) The snag is used as a stake to which the scion is tied until it has grown 9 to 12 in. tall, at which stage the snag is removed and the scion tied to a bamboo stake placed in the basket on the opposite side of the stock.
(6) The budded plants are then hardened off gradually by moving progressively into areas of increasing light in the plant shed.

Coffee.

Flowering is now general in two Liberian coffee manurial experiments which were planted on deep peat soil at the Federal Experiment Station, Jalan Kebun, in May-June, 1953.

Vegetables and Foodcrops.

A variety trial of *Cajanus indicus* was planted at Gajah Mati, Kedah, in July in which 6 varieties imported from Jamaica and Bahamas are being tested against the local Kedah strain. Observation plots of all these varieties have also been planted at the Federal Experiment Station, Kuala Lumpur. The variety Bahamas Late, imported in 1953, has proved to be very late and is only now beginning to bear seed. However, it has shown very vigorous vegetative growth and makes an excellent bush-cover.

Extension trials with two Kyoto strains of *Brassica chinensis* have had disappointing results: the heads have been of excellent quality but both varieties have proved to be more sensitive to poor growing conditions than the local strains, seed of which comes from China.

Green Manures.

Desmodium scorpiurus has now been established as a ground cover at Cameron Highlands and early growth has been good. On the plains,

at both Serdang and Kuala Lumpur, it tends to die out early as a result of insect damage. This particular creeping cover, imported from Papua in 1952, has a reputation of growing well under shade.

The two rapid-growing green manures, *Sesbania aculeata* and *S. speciosa*, have both grown very well on infertile padi land at Kg. Pusu, Kelantan, during the last off-season. They are also the most promising species in Kedah padi fields.

Goats.

A total of 41 pure and cross-bred goats was distributed from Serdang during June. This resulted from the policy of decentralization of breeding herds as an insurance against disease. The chief herds will be situated as follows:—

British Alpine,	—	Serdang, Penang and Malacca.
Saanan,	—	Serdang and Selangor.
Anglo Nubian,	—	Serdang and Negri Sembilan.

Pigs.

It has not been possible to test all the newly imported breeds at Serdang owing to lack of housing so it has been decided to simplify the trials and to carry them out in the field. Wessex Saddleback boars have been sent to Malacca and Perak, a Large Black boar to Perak, while the Large White boar has been retained at Serdang. Their half-bred progeny will be compared with the standard Chinese Black x Middle White crossbreds.

In a feeding trial at Serdang ten litters have now reached slaughter-weight of one picul liveweight.

MECHANISATION

Half-Yearly Report, April to September, 1954.

Compiled by the Agricultural Engineer I.

Recent Importations.

The following new implements and machines have been received:—

Fordson 3-furrow disc plough.
Sowall Seed Broadcaster No. 10 Bow-driven fiddle.
Sowall Seed Broadcaster No. 12 Gear-driven fiddle.

The following machines were loaned by the local agents to the Department of Agriculture for testing:—

Platypus Bogmaster Soft Land Tractor.
Garvie Thresher.

Tests and Modifications.

The Economy BS—51 Tractor.

Tests of the Economy tractor have now been completed and a report submitted to the local agents. The tractor, which is fitted with an 8½ h.p. air-cooled engine, was considered to be underpowered and unsuitable for normal agricultural holdings in Malaya but it would be suited to certain specialized work such as the maintenance of public gardens, golf courses and airfields.

The B.M.B. President Tractor.

The tests of the B.M.B. President tractor, vide *Malay. agric. J.*, **37**, 107, have continued and are now almost complete. It was tested at the Padi Test Plot at Serdang but was unable to pull the two-furrow plough supplied even when the land was firm and covered with a dense mat of vegetation. The tractor was unable to move itself on wet, ploughed land and would therefore be quite unsuitable for after-cultivation. The "President" is now undergoing trials on dry-land in Negri Sembilan where it is being used for row crop work.

The Platypus Bogmaster Tractor.

A Platypus Bogmaster tractor was made available for tests in June, 1954. Preliminary trials have been carried out on peat soils at Chenderong Balai in Perak, and on mineral soils at the padi plots at Serdang and at Pulau Gadong in Malacca. The main trials were to have taken place on wet bog soils on padi lands in the Tanjong Karang area and on an oil palm estate at Batang Berjuntai but the weather in the area has been abnormally dry and soil conditions have been far too good for testing a soft-land tractor.

The performance of the Bogmaster on mineral soils has been very good although a number of criticisms of details have been recorded. It appears to be particularly suitable for the after-cultivation of flooded land, an operation which is always difficult with wheeled tractors and is often now undertaken by a modified Caterpillar D4, an International TD6 or a David Brown Trackmaster.

The Shawnee Ditcher.

A Shawnee Ditcher, owned by the Selangor State Department, has been used to dig drains in peat soil at the Federal Experiment Station, Jalan Kebun. The ditcher was mounted on a Ferguson T.E.D. (vapourising oil) tractor which, because of the soft soil conditions, was mounted on Bombardier half-tracks; a heavy baulk of timber was placed on the ground under the main frame of the ditcher to provide a firm working base.

The ditcher was used to dig a main drain 3 ft. wide x 3 ft. deep; the drain sides were later sloped off by hand to give a width of 5 ft. at the top. The peat soil was wet and very heavy and there was an average of about 70 stumps or underground timbers per acre. Where stumps or timbers crossed the line of the drain, a short distance was left to be dug out by hand after the obstruction had been cut and removed.

The drain was 4,761 ft. long and the work was completed in 8 weeks, during which period 253 hr. were worked on 37 days. The average working rate was 18.7 ft. per hour or 3.4 hr. per chain. The ditcher could be operated by a Grade II Operator assisted by one labourer and the cost of digging averaged 79 cents per cu. yd. or $17.44 per chain (see Table I). No comparable costs for digging drains by hand are available but in July, 1952, when contract rates were higher than those now prevailing, a number of smaller drains were dug by a contractor at a cost equivalent to 72 cents per cu. yd. These drains were, however, dug in an area from which many of the stumps and timbers had been removed.

Soil Sterilizer.

An Alley three-way tipping trailer (vide *Malay. agric. J.* **36**, 261) has been converted for sterilizing soil for use in the nursery at the Federal Experiment Station, Serdang. A network of 1¼ in. diameter galvanized-iron water pipes, with ⅛ in. holes drilled every 12 in. was laid on a wooden frame in the bed of the trailer: these pipes can be joined by a flexible hose with a quick-acting coupling to a steam-pipe connected to the vertical boiler in the oil palm factory.

The trailer is normally used to sterilize jungle soil which is to be used for potting. It is loaded by hand with sieved soil, driven to the oil palm factory and connected to the steam supply: the surface of the soil is covered with sacks and the steam turned on until the soil temperature is raised to at least 180°F. throughout the whole load. The trailer is then taken to the nurseries where the sacks are removed and the

Table I.

Federal Experiment Station, Jalan Kebun.

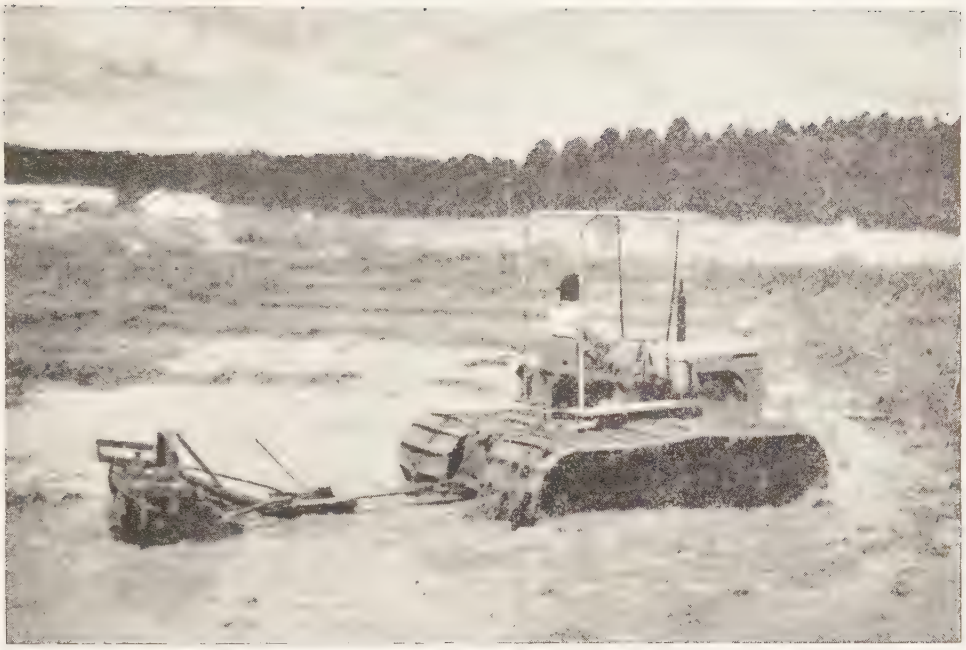
Shawnee Ditcher—Average Costs.

Ditcher Mounted on Ferguson T.E.D. (Vapourising Oil) Tractor on Bombardier Half-tracks.

	Labour.	Fuel.	Depreciation, Maintenance and Repair of Ditcher.	Depreciation, Maintenance and Repair of Tractor and Bombardier Half tracks.	Oil for Ditcher. *	Total Costs.
Average cost per hour	$0.97	$0.91	$ 1.13	$ 2.08	$ 0.04	$ 5.13
Average cost per cubic yard excavated	$0.15	$0.14	$ 0.17	$ 0.32	$ 0.01	$ 0.79
Average cost per chain of drain	$3.30	$3.09	$ 3.84	$ 7.07	$ 0.14	$17.44

* The Shawnee Ditcher used during the trial was not new and there was a considerable loss of oil through leakage from the cylinders.

NOTE:—All costs are given to the nearest cent.



The Platypus Bogmaster Soft Land Tractor under test at Serdang. A disc-harrow is being used for after-cultivation but a Kedah Roll is normally used for this operation.

The Platypus Bogmaster Tractor being used in conjunction with a Howard Model "R" trailing rotavator for initial cultivation of wet padi land. This implement has a working width of 72 in.

Sowing padi by "fiddle". The seed is soaked for 48 hours, germinated for 36 hours and dried off with rock phosphate before sowing. Seed rates as low as 20 lb. per acre have given good results. The fiddle gives a swath width of 19 to 22 ft.

Applying selective herbicides to young padi with a 12 ft. boom attached to two pressure retaining knapsack sprayers. The small lump at each end of the boom is a built-in filter. The combined working capacity of these two sprayers is 5-6 gallons at 175 lb. per sq. in. pressure. A similar 16 ft. boom has also been used. Spray liquids have been applied at 20 to 30 gallons per acre. Optimum dosages are still under investigation.

soil is unloaded. The time taken for a load to reach the necessary minimum temperature varies according to the moisture content of the soil and every effort is made to reduce costs by keeping the soil as dry as possible. One load of 60 cu. ft. (about 3,500 lb.) of dry soil was treated in 10 minutes, the steam pressure being 50 lb. per sq. in. at the start of the treatment.

At first there was some difficulty in ensuring that every part of the load attained the minimum temperature of 180°F. Trial loads were therefore explored with a soil thermometer and the cooler areas marked: the soil was then unloaded and the holes in the cool areas enlarged or extra holes drilled. This procedure was repeated until fairly uniform heating was achieved although the soil is invariably hotter at the bottom than at the top of the load: the thickness of the load is kept down to a maximum of 15 in. to minimize this effect.

At the Federal Experiment Station, Serdang, where steam is readily available from the oil palm factory, this sterilizer is considered to be economic. The cost of the modification was small in relation to the cost of a conventional wood-fired sterilizer and handling costs are markedly reduced since the soil is handled only once between the jungle and the potting sheds.

Investigations into the Cultivation of Wet Padi.

Three bow-operated hand fiddles have been used to sow a number of plots at the Padi Experiment Station, Telok Chengai, Kedah. One of the fiddles was an old commercial machine which had been used at Bukit Merah, Province Wellesley; regular distribution of seed was obtained because this fiddle was well run-in and ran smoothly and because the operators were able to practise with it before sowing commenced. The other two fiddles were made at Workshop and Pool and were not received until the day before the trials, hence the operators had no chance of becoming accustomed to them; the bearings of these machines were rather stiff and the seed distribution in the plots on which they were used was irregular.

The padi seeds used were soaked for 48 hr. and germinated for 36 to 48 hr. before sowing. The seeds had developed radicles about an inch long and there was a tendency for these to be cut off by the oscillating agitator. A simple test in which the radicles were deliberately cut off showed that the damaged seeds all developed new radicles but there was a check in growth, so that the advantage of pregermination was largely lost.

The width of spread obtained with the fiddles depended to a large extent on the effective height of the operator, which was influenced by the softness of the soil. In earlier trials at Bukit Merah a width of 22 ft. was obtained but only 19 to 20 ft. was found to be possible at Telok Chengai. An average working rate of 3 acres per hour was obtained at Bukit Merah but the work was rather slower at Telok Chengai because of the narrower spread and the difficulty of walking.

Two new Australian seed fiddles have been received but they arrived too late for inclusion in the Telok Chengai trials. The spinner of one of these fiddles is driven by a conventional bow and rotates backward-and-forwards at varying speeds; the other machine is provided with a handle-and-gear drive and the spinner rotates in one direction at constant speed.

Chemical Weed Control.

Experiments in previous seasons with chemical herbicides, mainly dusts, showed promise, and a new trial has been laid down in the broadcast padi plots at Telok Chengai. Five different hormone herbicides were applied, one as dust, the others as sprays; the plots were split for three different application rates.

The discards around the dusted plots were treated with an Allman Midget Duster. This engine-driven machine was mounted in a simple frame so that it could be carried by two men. Work could only be done in the early morning because of the risk of drift. The plots were treated with a Siroco Duster, a small hand machine which is well adapted for accurate work on experiments but is of little value where large areas are to be dusted. The herbicide was diluted with talc and the mixture applied at the rate of 20 lb. per acre, the formulation being adjusted to give the desired application of the active ingredient without changing the dusting rate.

The liquid spray applications were made with booms attached to pressure-retaining knapsack sprayers. Two-types of boom were used, one for the discards and the other for the plots. Both of these booms were carried by a pair of operators who carried Favori Colibri knapsack sprayers: the sprayers were connected to the booms by flexible hoses and nozzles were arranged at suitable intervals to ensure complete coverage with application rates of 20 to 30 gallons per acre.

The boom used for the discards was a commercial model manufactured by Messrs. Drake and Fletcher. The boom itself, which was 16 ft. long, was constructed of standard "slotted angles" and was provided with a convenient carrying handle at each end. A number of drop-legs were supplied with the boom and could be attached as required by simple clips: each drop-leg carried a pair of nozzles mounted in banjo unions and adjustable to spray upwards on to the under-sides of the leaves of row crops or downwards on to the plants or the ground. The individual drop-legs were connected together by short lengths of a flexible plastic tube and longer lengths of the same material were used to connect the boom to the knapsack sprayer.

The second boom, supplied by Messrs. Plant Protection, was 12 ft. long and was made of water pipe. The nozzles were fitted directly to the pipe and simple filters were attached at either end to remove foreign matter which might clog the jets. Carrying handles were welded to the boom, which was connected to the knapsack sprayers by lengths of rubber hose.

Both of the booms were very satisfactory and it was observed that spraying was more satisfactory than dusting because a better cover was obtained and the danger from drift was reduced. The area which could be covered with a single boom was limited because of the high proportion of time spent in recharging the sprayers and it was concluded that it would be desirable to use quick-release couplings in the boom connections so that two pairs of sprayers could be employed, one pair being charged (possibly by an engine-driven pump) while the others were spraying.

Investigation into the Cultivation of Dry Land Crops.

Eradication of Sheet Lalang.

An old-type Fordson Major tractor has been used to cultivate the site of an experiment to be laid down by the Forest Research Institute. The area, which was covered with dense sheet lalang, was hilly, and the tractor was fitted with Roadless D.G. half-tracks with full plates and grousers. The implements used were a Ransome 3-disc Hussar trailing disc-plough and a Ransome Baronet No. 3 trailing disc-harrow with 22 in. diameter cutaway discs.

The area was rough with scattered stumps and timbers and it was decided that the lalang should be burnt off to improve visibility and to reduce clogging of the implements. The lalang regenerated rapidly and flowered soon after burning and it was found necessary to complete the initial cultivation before the seedling stage was reached because the seeds clogged the tractor's radiator.

The old-type Fordson Major on half-tracks performed well. Where the experimental layout dictated the direction of work, it was capable of working up and down hills and it was stable on cross slopes. The implements, although old, also performed well.

Removal of Timbers and Stumps from Peat Soil.

An attempt has been made to mechanise partially the removal of stumps and buried timbers from peat soils at the Federal Experiment Station, Jalan Kebun. Table II, which shows the number of timbers and stumps in the area cleared and the number and size of timbers in nearby areas, gives an idea of the nature of the work. The area was slashed and changkolled by hand and the timbers located by the labourers were marked. Wire ropes were then attached and the timbers dragged out by the winch on the Water Buffalo tractor. The site was not required for experiments so it was not necessary to remove the timbers, which were roughly stacked and burnt *in situ*. In some of the neighbouring plots the timbers were cut up by hand and carted away in trailers towed by M.G.5 tractors.

After all the obvious timbers had been removed the area was cultivated by a Ferguson T.E.F. (diesel) tractor on double pneumatic wheels pulling a spring-tined tiller. This operation helped to control the regeneration of lalang and also located further timbers: these were marked and were later winched out by the Water Buffalo tractor.

Table II.

Federal Experiment Station, Jalan Kebun.

Occurrence of Stumps and Timbers.

Trial.	Method of Removal.	Block Reference.	No. Of Stumps Per Acre Grouped According To Pull Required For Removal.			Total Stumps per Acre.
			5,000—10,000 lb. Pull.	10,000—15,000 lb. Pull.	Over 15,000 lb. Pull.	
Dynamometer trials, July, 1952	Hand winch	1	20	25	30	75
		2	30	40	Nil	70
		3 & 4	20	25	72	117
Costing trials, July, 1954	Water Buffalo tractor winch	I	Not recorded.	Not recorded.	Not recorded.	107
		II	- do -	- do -	- do -	149
	Average		23.3	30	34	103.6

The Water Buffalo tractor was not entirely satisfactory for this work. Two of the reinforced rubber pads which form the track broke on different occasions and had to be replaced in the field. The bevel gear in the winch drive stripped and, since no spares were available, a replacement had to be made: this replacement, however, also failed and work was abandoned after two acres had been cleared. When the tractor was withdrawn it was noted that several of the track pads were damaged and would probably have broken if work had continued *.

A total of 256 stumps were removed from two acres in 104 working hours by a gang of four men assisted by the Water Buffalo tractor. The costs of this work are given in Table III but, because of the difficulty of ascribing fair depreciation, maintenance and repair charges to the Water Buffalo tractor, the total cost of $634.50 shown should be regarded as an approximation.

In July, 1952, when clearing started at Federal Experiment Station, Jalan Kebun, the cost of comparable work on contract was $850 per acre on undrained, and $808 on drained blocks but the cost of labour has since fallen and the plots adjoining those where the Water Buffalo was used are now being cleared on contract for $650 per acre. It is therefore concluded that mechanical removal of stumps is not markedly cheaper than hand work and the high breakage rate renders it uneconomical in most circumstances.

Table III.

Federal Experiment Station, Jalan Kebun.

Approximate Cost of Removing Stumps and Timbers from Peat Soils.

Operation.		Approximate Cost per acre.
PRELIMINARY WORK.		
Slashing, changkolling and marking. On contract:-		$ 150.00
REMOVAL OF TIMBERS.		
(Two rounds) Labour:	$ 85.50	
Fuel:	7.50	
Depreciation, maintenance and repair: (see note)	364.00	457.00
CULTIVATION with spring-tined tiller and marking timbers for second round, estimated at:-		7.50
BURNING TIMBER, estimated at:-		20.00
Total		$ 634.50

NOTE:—In the absence of field experience, the useful life of the Water Buffalo has been estimated at 5,000 hr. The initial cost of the tractor was $21,000 and the depreciation charge is thus $4.20 and the repair charge $2.10 per hr. The cost of maintenance is estimated at 70 cents per hr. bringing the total charge to $7 per hr.

* The Water Buffalo tractor used in these trials was an early model purchased in 1952. The manufacturers state that a larger diameter steel cable giving a higher tensile strength is incorporated in the latest type of track pad and that a different winch is fitted to current tractors.

NOTES ON EXTENSION WORK

JUNE TO AUGUST, 1954

Compiled by the Chief Field Officer.

Padi.

Field work is in progress in all areas, except Selangor, in preparation for the new padi season. Weather conditions have been favourable on the East Coast.

Extension trials and demonstration plots with the current standard manurial treatments for the area are being laid down on an increased scale.

In Malacca there will be 30 replications of a six-plot manurial trial designed by the Agronomy Branch to test the response to phosphate in the presence and absence of nitrogen. Numerous simple demonstration plots of manure versus no manure are also being arranged on cultivators' own land. In Negri Sembilan 157 sites for manurial trials have been selected and in Perak 300. Results of manurial trials in Pahang have been uniformly good, the lowest responses being about 40 gantangs per acre and the highest over 200 gantangs per acre. More than 200 planters have come forward with requests to the Department to purchase fertiliser on their behalf, and arrangements with commercial firms are now being made.

In Kedah, manurial trials comparing types of phosphates followed by a top dressing of sulphate of ammonia are being laid down in all localities. This is the third successive year for these trials, in some cases treatments are being repeated on the same block and other new sites have been selected at random.

The padi fertiliser subsidy scheme for the East Coast is in operation for the third year; the subsidy is at a reduced rate of $4 per 100 lb. as compared with $6 and $8 for the previous two seasons. The volume of sales has been disappointing, only 95½ tons have been sold as against 188 tons for the same period last year.

There is better news from Kedah where the State Agricultural Officer reports increased sales at full commercial prices. Total distribution of Christmas Island rock phosphate, double superphosphate and sulphate of ammonia was 1,114 cwt., 36 cwt. and 365 cwt. respectively.

Extension trials with new selections and improved varieties are being laid down extensively in Malacca, Negri Sembilan and Perak. During the quarter 15,049 gantangs of seed was distributed.

There has been a welcome revival in padi cultivation in Johore. The State Agricultural Officer reports that generally over Johore more than four times the acreage has been planted compared with the same date last year.

Off-season cropping of wet padi land is important in Malacca, Selangor and Province Wellesley. In Province Wellesley cropping is mainly confined to a second padi crop using short term Taiwan padi. The Settlement Agricultural Officer reports that a total of about 9,000 acres was planted this year and the area is expected to increase in 1955. In Selangor some 3,000 acres were planted to dry land crops such as maize, soya beans, sweet potatoes and tobacco.

The All Malaya Padi Competition was held in August. The first prize was won by a Pahang grower, Che Tebah binti Awang of Paya Serandu, Pekan. This is a small padi area in a locality that is not noted for high quality padi and Che Tebah's success is of particular interest. She farms 3 acres of padi land, producing 900-1,200 gantangs, in a 350 acre *paya* that is reported to be one of the better cultivated *paya* in the State. The growers run co-operative manured nurseries and they have co-operated with the Department in extension manurial trials. Che Tebah and her family do their own cultivation with the help of buffaloes, of which they own ten. In addition they farm 3½ acres of coconuts producing 24 piculs of copra per year, and they own 70 head of poultry. They are a first class farming family.

Rubber.

During the quarter the main Departmental activity has been organising the collection and the planting of clonal seeds in seedling nurseries. The success of the Replanting Scheme must depend largely on our ability to produce clonal seedlings in sufficient quantity. T.J.1 is the approved clone for seed purposes, and as a result of exhaustive searches new approved areas have been found, and in consequence collections for the year now total over 12½ million as compared with over 8½ million for 1953. Seed collections will continue for a further 2 to 3 months.

During the quarter 228,665 clonal seedlings and 29,104 yards of budwood were distributed.

The State Agricultural Officer, Pahang, reports that alienation of land for new plantings continues. A limited number of clonal seedlings will be available and an intensified budding campaign is being arranged. The difficulties of budding rubber under kampong conditions is illustrated by the following report: "An interesting experiment in the budding of kampong rubber has been carried out in Kampong Lanjut near Temerloh. The percentage of successful buddings in the first round was 41 (1780 successes out of 4405 points). Rebudding was carried out on a well maintained holding in May with 83 per cent success (124 successes out of 149 points). In June, rebudding was carried out in the less well maintained holdings with a success of only 31 per cent (576 successes out of 1845 rebuddings). In all 889 yards of budwood have been used to bud 7588 points with a total success of 2480, which works out at about 3 points per yard of budwood. This experiment gives weight to the oft-repeated propaganda of the Department that kampong rubber must be properly

grown and not left to struggle along. A further 1237 points were budded in August."

Mechanisation.

In the Tanjong Karang area of Selangor three Turner threshing machines working on hire threshed a total of 36,778 gantangs of padi. This is a Rural Industrial Development Authority sponsored scheme managed in the first year by the State Agricultural Officer. The charge was one gantang in every twenty threshed.

Fruit.

Sales of budded fruit trees from Agricultural Stations during the quarter totalled 6,631.

Pineapples.

The State Agricultural Officer, Johore, reports that the crop has been a particularly good one and heavy yields have been obtained by both small and large growers. While to some extent this may be seasonal, it is probable that manuring, spraying, and improved drainage and land consolidation have contributed to a great measure.

In Selangor the commencement of extension work in manuring and rehabilitating old pineapple areas has been delayed owing to staff difficulties. New areas have been planted on peat by demobilised Special Constables. To-date 59,000 suckers have been supplied.

Livestock.

Poultry.

During the quarter sales of poultry and eggs were as follows:—

Cockerels and pullets	326
Chicks	1,198
Hatching eggs	814

Pigs.

Sales of pigs were as follows:—

Boars	64
Gilts	43
Piglings	56
	163

There has been a fall in the price of foodstuffs which has eased the position of pig rearers.

Agricultural Education.

This has followed the usual diverse lines from visits and lectures in villages to organised demonstrations and residential courses on Agri-

cultural Stations. These are illustrated by the following extracts from reports:—

Pahang:

"The lecture room at Temerloh Agricultural Station was completed and furniture constructed by the Station carpenter. The second building at Pekan is almost completed and the first course is due to start in October. This is a school with hostel attached and the intention is to hold short courses of two weeks duration for 20 persons at a time.

School gardens were regularly visited. Specially designed shields were issued as prizes to the winners of group competitions for the Rompin and Pekan groups.

The Penghulus refresher course was held at Kuala Lipis during August and the opportunity was taken to give them lectures on: (1) Improvement of Padi Varieties, (2) Manuring of Padi, (3) Kampong Rubber Nurseries and (4) Field Budding of Rubber. Further talks and demonstrations were given in the field at Sungei Ruan, Gali and Dong Stations."

Malacca:

"Two Civics Courses (Indian estate labourers and Malay kampong leaders) were held in the Settlement during the quarter. Lectures and demonstrations on the work of the Department were given at Sungei Udang and Pulau Gadong."

Johore:

"*Farm School.* A scheme has been put up for the establishment of a hostel for the running of training courses at Central Agricultural Station, Ayer Hitam, and a decision is awaited.

Demonstrations. Fruit and rubber nurseries have been established at Buloh Kasap Malay School in Johore North. Budding was done by the students themselves, and budded plants (rambutans) were sold to raise funds for the school.

Demonstration fruit propagation plots have been established at 9 centres in Muar District where small instructional courses can be run.

Lectures. A start has been made by the Agricultural Assistant, Johore Bahru, with the giving of lectures on pigs and poultry at new villages, illustrating them with the help of a film strip projector. There is an urgent need for the production of special local photographs for the purpose.

A series of 12 lectures at the rate of three per week, were given to 15 young prisoners in the Muar Prison, covering composting, nursery work, soils, plant nutrition, planting techniques, budgrafting etc., and educational films "Getah" parts I and II, "Selangor Rice Bowl", "Eggs Galore", and "Gersik Rubber Factory" were also shown to them."

Penang and Province Wellesley:

"*School Gardens.* Fruit nurseries have been established in 4 school gardens and a Departmental plant propagator gives instructional talks and demonstrations on fruit propagation.

Young Farmers Club. Two new villages in Province Wellesley have Young Farmers' Clubs and these clubs are being given talks and demonstrations by Departmental officers on all aspects of agriculture. In addition, parties are taken round different estates and business concerns of economic importance."

Kedah:

"*Lectures and Demonstrations.* The Assistant Agricultural Officer (North) spent a considerable amount of time lecturing to padi planters on the subject of closer spacing of seedlings in the field, and in the course of 23 lectures he addressed audiences totalling over 2,200 persons, most of whom were women. All aspects of padi planting were covered, but the accent was upon closer planting and this, from all indications, is being enthusiastically received.

Demonstration plots of approximately one relong each, totalling 112 in number, were laid down in various mukims in Kota Star on cultivators' own land, to demonstrate the effects of closer planting and of the use of approved fertilisers—the latter being supplied free by Messrs. Imperial Chemical Industries (Malaya) Ltd."

General Notes

NEW OFFICES FOR THE HEADQUARTERS OF THE AGRONOMY BRANCH

On 1st March, 1947, the Short Term Food Production Organization was absorbed into the Department of Agriculture and a temporary building adjacent to Departmental Headquarters was used to house the new Food Production Branch. At a later date, the duties of Agricultural Officer, Food Production, were merged with those of the Senior Agriculturist and the title of the new post was changed to Senior Agricultural Officer, Research. This officer was responsible to the Chief Research Officer for the coordination of all field investigations, both on Federal Experiment Stations and elsewhere. However, in 1950 it became evident that the considerable post-war expansion of field investigations made it difficult for any Chief Research Officer to administer both fundamental and applied research and proposals were put forward to create an Agronomy Branch, equal in status to the Field and Research Branches. These proposals were approved by Government and the new Branch came into being on the 1st January, 1952. The Senior Agronomist thus became responsible for all applied agricultural research in the Federation and for livestock research and investigational work for which the Department of Agriculture was responsible, including statistical analysis and interpretation of all applied research. In so far as agricultural engineering was an integral part of crop investigations, the new posts of Agricultural Engineers were absorbed into an Engineering Division within the Agronomy Branch.

This reorganization of the Department necessitated an increase in office accommodation for the Agronomy Headquarters and funds for this purpose were made available in the Public Works Department Budget for 1953. The cost of these new offices was estimated at only $50,000 since it was planned to make part use of an old store at the foot of the hill leading up to the Department Headquarters in Swettenham Road.

Construction of the new offices commenced in October, 1953, and was virtually complete by the end of June, 1954, with the exception of certain internal fixtures. Considerable earth-levelling had proved to be necessary and the new building was constructed on two levels with an interconnecting covered way. In the lower building there are three offices for the Senior Agronomist, Statistician and two Agronomists, while the upper building is divided into two large rooms, one for clerical staff and the other for statistical and recording staff.

The orientation of the lower building and the positioning of windows makes it very pleasantly cool, and the modest area of short grass which surrounds this office adds to its amenity.

Although one large *Albizzia falcata* tree had to be felled during

construction of the offices it was most fortunate that a large specimen of *Millettia atropurpurea* and an interesting clump of Giant Bamboo, *Dendrocalamus giganteus*, were spared to provide welcome shade. Subsequently a limited number of trees and shrubs have been planted and these include the following interesting species:—

Arytera littoralis
Bombycidendron Vidalianum
Carissa carandas
Eucalyptus sideroxylon
Eugenia Michelii
Lagerstroemia indica
Michelia champaca
Pinus hondurensis

E. F. A.

NEW PLANT PATHOLOGY LABORATORY FOR THE DEPARTMENT OF AGRICULTURE

The two main buildings which house the Research Branch of the Department of Agriculture were completed in 1939.* At that time these buildings provided sufficient laboratory and office accommodation for all the Divisions of the Branch but since then expansion of staff, particularly in the Botany Division, has rendered the accommodation inadequate.

It was therefore decided that the Botany Division should take over that part of the building occupied by the Plant Pathology Division and that a new building for the Plant Pathology Division should be erected. Work on this building was completed in August, 1954.

The basic plan of the building was prepared by the Acting Senior Plant Pathologist and the detailed design was drawn up by the Architectural Branch (Headquarters) of the Public Works Department.

The building, which is 56 feet long and 27 feet broad, consists of two storeys. The upper storey contains a large laboratory for the general examination and investigation of diseased plants, with offices for the Senior Plant Pathologist and Plant Pathologist opening off it. There is also a small store-room on this floor.

On the ground floor are various smaller rooms. These include rooms where specialised aspects of plant pathology can be studied viz., a culture room where fungi and bacteria under investigation can be grown in pure culture, a herbarium and museum where specimens of diseased plants are kept for reference and an inoculation room where plants can be experimentally infected with diseases. There are also a preparation room, where apparatus can be sterilised, culture media made up etc., a photographic darkroom, a clerk's office and a store-room.

* *Malayan Agricultural Journal*, Vol. 28, No. 3, p. 133, 1940.

In the vicinity is an insect-proof plant house, completed a few years ago, where pot experiments can be carried out. A plant shelter in which the numerous plants required for inoculation experiments can be grown is also to be built in the near future. In conjunction with these, the new laboratory building comprises a compact but complete unit where work on all aspects of plant pathology and mycology can be undertaken.

A. J.

Departmental Notes

Retirement of Che Ismail bin Haji Mohd. Salleh.

The retirement is announced of Che Ismail bin Haji Mohd. Salleh, Assistant Agricultural Officer, Perak, with effect from 1st October, 1954.

Che Ismail bin Haji Mohd. Salleh joined the Department of Agriculture in 1923 and after training in Kuala Lumpur was posted to Perak where he served until 1930. In that year he was transferred to Pahang where he stayed until 1948. His outstanding work during his service in Pahang was undoubtedly that as the first Manager of the Temerloh Rice Mill and it was largely through Che Ismail's intimate knowledge of the Malay smallholders and his business acumen that a successful start was made to a new venture.

In 1948 he returned to Perak as Agricultural Assistant, Larut & Matang, and in 1949 was appointed in-charge of the North Perak circle, a position he held until his retirement. He was promoted to Assistant Agricultural Officer in 1952.

During the years he was in charge of North Perak he showed very considerable administrative ability. He was popular with his subordinates and yet maintained strict discipline and a high standard of work.

Socially Che Ismail has now become one of the leading Malays in Taiping and is highly respected by members of all communities.

His retirement is a loss to the Department, but his services to agriculture have not been lost, as he has obtained an appointment with the Rubber Industry (Replanting) Board as Assistant Replanting Officer, Perak North.

We wish him every success in his new post and a long and happy retirement.

Appointments.

Mr. M. G. Hawson, Agronomist, Kedah, with effect from the 13th September, 1954.

Mr. E. J. H. Berwick, State Agricultural Officer, Kedah and Perlis, with effect from the 6th November, 1954.

Leave.

The following officers have returned from leave:—

Mr. A. Cumming, Agricultural Development Officer, on the 1st November, 1954.

Mr. E. J. H. Berwick, Senior Agricultural Officer, on the 1st November, 1954.

Mr. J. J. Holmes, Publications Officer, on the 29th November, 1954.

Mr. P. G. Coleman, Agricultural Officer, proceeded on leave on the 25th October, 1954.

MARKET PRICES

July to September, 1954.

Rubber.—For the first time since May, 1953, the Singapore price of No. 1 R.S.S., f.o.b., in bales, exceeded 70 cents per lb. in July. On the 1st July the price was 63¼ cents, and for most of the first half of the month it was in excess of 70 cents, with the highest price, 71⅞ cents, being paid on the 6th. However, on the last day of business, the 30th, the price was back to where it started—68¼ cents. The average price for July was 69.93 cents.

The market was closed for the August Bank Holiday, and on re-opening on the 3rd the price was 68⅝ cents per lb. There was a gradual fall to 65¼ cents on the 14th August but by the 30th the price had reached 68⅝ cents—only to fall by 1⅛ cents on the last day of the month. The average price for August was 67.18 cents.

There was a gradual increase in price from the 1st to the 14th September when the price was 70 7/16 per lb. The price fluctuated during the rest of the month but was above 70 cents on most days, to give an average for September of 69.47 cents.

The above prices are as reported by the Singapore Chamber of Commerce and have been taken from the Monthly Statistical Bulletin of the Federation of Malaya.

The average prices paid for smallholders' rubber at three centres in the Federation of Malaya during the third quarter of 1954 are given in Table I.

Table I.

Average Monthly Prices Paid by Local Dealers for Smallholders' Rubber, July to September, 1954.

(Dollars per picul of 133 1/3 lbs.)

Grades.	Taiping, Perak.			Seremban, Negri Sembilan.			Batu Pahat, Johore.		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Smoked Sheet	78.74	76.20	78.15	78.31	74.88	77.62	77.79	74.17	77.08
Unsmoked Sheet	64.40	63.10	65.70	62.79	60.08	61.46	69.21	66.33	67.76
Scrap	38.30	41.94	38.92	46.95	44.20	42.90	28.76	25.07	27.77

This Table has been compiled from statistics supplied by the Registrar of Statistics, Federation of Malaya.

Tea.—The average prices paid for Ceylon teas at the public sales held in Colombo on the 28th September, 1954, and as reported in the Weekly Tea Market Report of the Colombo Brokers' Association, were as follows, in rupees per lb.:—High Grown Teas 2.91, Medium Grown Teas 2.65, and Low Grown Teas 2.71.

There have been no sales of Malayan tea in Colombo during the first nine months of 1954.

In a return published by the Registrar of Statistics, Federation of Malaya, production of made tea in the Federation, as declared by estates, during the quarter under review was given as 50,935 lbs. green teas and 1,097,733 lbs. black teas.

Derris.—The price of this commodity remained at $100 per picul throughout the quarter.

Rice.—The weekly ration of Government imported rice has remained unchanged at 5 katis * for males, 4 katis for females and 3½ katis for children. The maximum retail prices of High Grade and Low Grade rice are 38 and 22 cents per kati respectively. There are no maximum prices for Medium Grade and local rices.

Table II.

Singapore Prices of Various Agricultural Products.

(Dollars per picul)

Date	Copra, Sundried	Coconut oil*	Pepper, F.A.Q. Muntok white	Pepper, Gen. Muntok white	Gambier, Cube	Sago Flour, Lingga	Tapioca Flour No. 1	Oilcake, Round
1954								
5th July -	30.75	55.00	195.00	205.00	48.00	13.25	17.00	12.50
12th July -	30.25	52.50	255.00	265.00	48.00	13.37½	16.75	13.50
19th July -	30.00	52.00	215.00	225.00	48.00	13.25	16.50	12.00
27th July -	31.50	53.00	215.00	225.00	48.00	13.25	16.50	12.50
3rd Aug. -	30.25	52.50	220.00	230.00	46.00	13.12½	16.50	12.50
10th Aug. -	29.25	51.00	215.00	225.00	50.00	13.00	16.50	12.50
18th Aug. -	28.50	50.00	218.00	228.00	50.00	13.00	16.25	12.50
23rd Aug. -	28.25	49.00	227.50	232.50	48.00	13.00	16.75	12.50
30th Aug. -	28.50	48.50	222.50	232 50	46.00	13.00	16.75	12.50
6th Sept. -	28.00	48.50	212.50	222.50	46.00	13.00	17.00	12.25
13th Sept. -	28.50	48.50	212.50	222.50	46.00	12.75	17.00	12.50
20th Sept. -	29.50	49.50	221.50	231.50	46.00	12.87½	16.75	12.50
27th Sept. -	32.25	55.50	217.50	227.50	45.00	12.87½	16.50	14.50

* F.O.B.

The above prices are taken from the weekly reports of the Singapore Chamber of Commerce.

* 1 kati = 1⅓ lb.

FEDERATION OF MALAYA

PRODUCTION OF PALM OIL AND KERNELS.

(In long tons as declared by Estates)

Month	Palm Oil		Palm Kernels	
	1953	1954	1953	1954
January	3,946	4,143	1,008	1,139
February	3,611	3,908	923	1,066
March	3,778	4,442	1,031	1,210
April	4,061	4,674	1,066	1,228
May	4,209	5,251	1,076	1,396
June	4,122	4,188	1,056	1,114
July	4,500	4,580	1,150	1,162
August	3,980	4,694	1,000	1,236
September	4,180	4,319	1,059	1,157
October	4,083		1,063	
November	4,026		1,064	
December	4,602		1,173	
Total	49,038	(40,199)	12,669	(10,708)

In September, 52 estates (planted area 99,156 acres) were in production out of a total of 63 oil palm estates (planted area 109,127 acres).

MALAYAN AGRICULTURAL EXPORTS,

APRIL-JUNE, 1954.

Product	Net Exports in Tons.			
	Year 1952	Year 1953	April-June, 1953	April-June, 1954
Arecanuts	10,467	11,580	1,631	546
Coconuts, fresh † ‡	94,024 †	88,315 †	26,826 †	28,125 †
Coconut oil ‡	65,113	60,779	12,804	18,980
Copra ‡	27,821 *	9,751 *	2,022	11,811 *
Copra cake	60,287 *	59,129 *	12,224 *	10,376 *
Gambier, all kinds	94 *	160 *	6	25 *
Palm Oil	46,008	47,579	11,755	14,096
Pineapples, canned	11,762	17,368	4,169	6,644
Rubber ¶	582,649 ¶	572,792 ¶	132,685 ¶	129,354 ¶
Sago,—flour	19,146	28,444	8,601	9,542
„ —pearl	5,353	5,896	1,453	1,059
„ —raw	24,835 *	27,246 *	5,861 *	5,569 *
Tapioca,—flake	39 *	128 *	57 *	158
„ —flour	4,075 *	7,362 *	2,422 *	683 *
„ —pearl	6,304	5,474	1,039	2,229
Derris	13 *	10	—	6
‡ Copra equivalent	79,868	90,781	23,365	19,594

¶ production (Federation of Malaya). † hundreds in number. * net imports.

FEDERATION OF MALAYA RUBBER PRODUCTION.

(In long tons, dry weight)

Month	Estates		Smallholdings (Estimated)		Total	
	1953	1954	1953	1954	1953	1954
January	31,354	30,278	23,514	19,014	54,868	49,292
February	23,423	25,354	19,140	17,913	42,563	43,267
March	26,898	24,556	16,882	17,452	43,780	42,008
April	26,155	24,749	16,805	15,339	42,960	40,088
May	27,820	27,572	17,679	18,585	45,499	46,157
June	27,202	26,873	17,024	16,236	44,226	43,109
July	30,188	30,970	20,400	22,931	50,588	53,901
August	29,511	30,826	21,491	21,576	51,002	52,402
September	28,934	30,067	18,394	23,371	47,328	53,438
October	30,064		19,202		49,266	
November	28,985		19,250		48,235	
December	30,583		21,894		52,477	
Total	341,117	(251,245)	231,675	(172,417)	572,792	(423,662)
Total 1952	341,078		241,571		582,649	

This Table has been compiled from statistics published by the Registrar of Statistics, Federation of Malaya.

Production on smallholdings (estates of less than 100 acres) is taken as the total of purchases from smallholders reported by licensed dealers.

FEDERATION OF MALAYA

PRODUCTION OF COPRA, COCONUT OIL AND COPRA CAKE.

(in tons)

Month	Copra Production						Coconut Oil Production		Copra Cake (Poonac) Manufactured	
	Estates		Smallholdings (estimated)		Total		Oil Mills		Oil Mills	
	1953	1954 (a)	1953	1954	1953	1954	1953	1954	1953	1954
January	2,555	3,123	8,241	9,470	10,796	12,593	5,597	8,837	3,594	5,583
February	2,405	2,789	6,092	9,616	8,497	12,405	4,236	7,798	2,694	4,891
March	2,793	3,072	6,703	11,482	9,496	14,554	4,800	8,721	2,981	5,487
April	2,753	2,993	7,972	9,922	10,725	12,915	5,294	6,961	3,379	4,515
May	3,306	3,803	8,744	10,128	12,050	13,931	5,666	8,098	3,633	5,195
June	3,357	3,763	9,842	12,175	13,199	15,938	6,478	8,158	4,078	5,181
July	4,196	4,112	9,718	11,850	13,914	15,962	6,699	8,582	4,308	5,505
August	4,070	3,886	11,179	11,237	15,249	15,123	7,935	8,480	5,048	5,489
September	4,103	3,481	10,332	10,631	14,435	14,112	7,789	8,501	5,043	5,403
October	3,890		11,998		15,888		8,808		5,607	
November	3,137		11,265		14,402		7,776		4,900	
December	3,565		9,580		13,145		8,381		5,157	
Total	40,130	(31,022)	111,666	(96,511)	151,796	(127,533)	79,459	(74,136)	50,422	(47,249)

Notes:—1. The above Table has been compiled from statistics published by the Registrar of Statistics, Federation of Malaya. Minor changes in these figures are made by Registrar of Statistics in his quarterly Copra, Coconut Oil and Copra Cake Statistics.

2. Estate copra production and coconut oil production are as declared by estates and oil mills respectively.

3. Statistics of smallholding coconut oil production are not available.

4. Smallholding copra production for commercial purposes is estimated from the formula: imports + estate stocks (opening) + estate production + smallholding production = exports + local oil mill consumption + estate stocks (closing).

(a) Includes copra equivalent of sales of fresh nuts by estates.

FEDERATION OF MALAYA RICE STATISTICS

Summary of Acreages and Production, Season 1953-1954.

State or Settlement (1)	TOTAL WET AND DRY PADI								
	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Production		
							Padi (5)	per cent of total	Rice (6)
	acres	per cent of total	acres	per cent of (2)	acres	per cent of (2)	gantangs (000's)		tons
Perlis	48,900	5.8	1,420	2.9	47,480	97.1	20,172	7.8	31,770
Kedah	284,740	34.0	790	0.3	283,950	99.7	114,520	44.6	180,350
Kelantan	160,900	19.2	15,810	9.8	145,090	90.2	27,998	10.9	44,090
Terngganu	50,270	6.0	2,660	5.3	47,610	94.7	6,188	2.4	9,740
Penang & Province Wellesley	38,940	4.7	—	—	38,940	100.0	12,195	4.7	19,200
Perak	105,430	12.6	460	0.4	104,970	99.6	29,200	11.4	45,980
Selangor	47,160	5.6	840	1.8	46,320	98.2	17,665	6.9	27,820
Pahang	37,090	4.4	110	0.3	36,980	99.7	7,848	3.1	12,360
Negri Sembilan	30,500	3.6	160	0.5	30,340	99.5	11,613	4.5	18,290
Malacca	29,470	3.5	900	3.1	28,570	96.9	8,459	3.3	13,320
Johore	5,000	0.6	330	6.6	4,670	93.4	1,147	0.4	1,810
Total Main Crop	838,400	100.0	23,480	2.8	814,920	97.2	257,005	100.0	404,730
Off-Season Crop, 1953	7,590	—	80	1.1	7,510	98.9	2,182	—	3,440
Total 1953-1954	845,990	—	23,560	2.8	822,430	97.2	259,187	—	408,170
Total 1952-1953	834,010	—	9,200	1.1	824,810	98.9	280,033	—	441,000

Acreage to nearest 10 acres.
Rice production to nearest 10 tons.
Conversion rate 635 gantangs padi = 1 ton rice (i.e. milling recovery = 63 per cent.)

FEDERATION OF MALAYA RICE STATISTICS

Summary of Acreages and Production, Season 1953-1954.

Wet Padi.

State or Settlement (1)	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Average Yield per Acre			Production			Remarks (9)
							Padi (5)	per cent. of main season average yield	Rice (6)	Padi (7)	per cent. of total	Rice (8)	
	acres	per cent. of total	acres	per cent. of (2)	acres	per cent. of (2)	gantangs		lbs.	gantangs (000's)		tons	
Perlis	48,790	6.1	1,420	2.9	47,370	97.1	426	131.5	1,500	20,157	8.0	31,740	1,420 acres destroyed by drought.
Kedah	282,940	35.3	790	0.3	282,150	99.7	405	125.0	1,426	114,257	45.4	179,930	790 acres destroyed by pests, diseases, drought or flood.
Kelantan	137,900	17.2	15,730	11.4	122,170	88.6	199	61.4	700	24,319	9.7	38,300	15,730 acres destroyed due to flood, ingress of sea water, pest and disease, late planting etc.
Trengganu	41,610	5.2	2,640	6.3	38,970	93.7	137	42.3	482	5,346	2.1	8,420	2,640 acres not harvested bcause of empty grains and damage by cattle and buffaloes.
Penang and P. Wellesley	38,920	4.9	—	—	38,920	100.0	313	96.6	1,102	12,192	4.8	19,200	
Perak	103,910	13.0	460	0.4	103,450	99.6	281	86.7	989	29,049	11.5	45,740	460 acres not harvested because of late planting and deep water.
Selangor	47,160	5.9	840	1.8	46,320	98.2	381	117.6	1,341	17,665	7.0	27,820	840 acres not harvested due to late planting and pest damage.
Pahang	35,060	4.4	10	—	35,050	100.0	217	67.0	764	7,601	3.0	11,970	10 acres not harvested due to empty grains and damage by pest.
N. Sembilan	30,490	3.8	160	0.5	30,330	99.5	383	118.2	1,348	11,611	4.6	18,290	160 acres not harvested due to empty grains, pest and damage by flood.
Malacca	29,460	3.6	900	3.1	28,560	96.9	296	91.4	1,042	8,458	3.4	13,320	900 acres destroyed due to late planting, pests etc.
Johore	4,970	0.6	320	6.4	4,650	93.6	246	75.9	866	1,142	0.5	1,800	320 acres destroyed due to late planting, dry weather and pest damage.
Total Main Crop	801,210	100.0	23,270	2.9	777,940	97.1	324	100.0	1,143	251,797	100.0	396,530	
Off-Season Crop, 1953	7,550	—	80	1.1	7,470	98.9	291	—	1,027	2,177	—	3,430	
Total 1953-54	808,760	—	23,350	2.9	785,410	97.1	323	—	1,141	253,974	—	399,960	
Total 1952-53	789,840	—	8,890	1.1	780,950	98.9	350	—	1,232	273,518	—	430,740	

Acreage to nearest 10 acres.
Rice production to nearest 10 tons.
Conversion rate 635 gantangs padi = 1 ton rice (i.e. milling recovery = 63 per cent.)

FEDERATION OF MALAYA RICE STATISTICS

Summary of Acreages and Production, Season 1953-1954.

Dry Padi.

State or Settlement (1)	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Average Yield per Acre			Production			Remarks (9)
							Padi (5)	per cent of main season average yield	Rice (6)	Padi (7)	per cent. of total	Rice (8)	
	acres	per cent. of total	acres	per cent. of (2)	acres	per cent. of (2)	gantangs		lbs.	gantangs (000's)		tons	
Perlis	110	0.3	—	—	110	100.0	141	100.0	496	15	0.3	20	
Kedah	1,800	4.8	—	—	1,800	100.0	146	103.5	514	263	5.0	410	
Kelantan	23,000	61.8	80	0.3	22,920	99.7	160	113.5	563	3,679	70.6	5,790	80 acres could not be harvested due to late planting and damage by pests.
Trengganu	8,660	23.3	30	0.3	8,630	99.7	97	68.8	341	842	16.2	1,330	30 acres destroyed by floods.
Penang and P. Wellesley	20	0.1	—	—	20	100.0	170	120.6	598	3	0.1	10	
Perak	1,520	4.1	—	—	1,520	100.0	99	70.2	348	151	2.9	240	
Selangor	—	—	—	—	—	—	—	—	—	—	—	—	
Pahang	2,030	5.5	90	4.4	1,940	95.6	128	90.8	451	247	4.8	390	90 acres damaged due to lodging and damage by pests.
N. Sembilan	10	—	—	—	10	100.0	150	106.4	528	2	—	—	
Malacca	10	—	—	—	10	100.0	232	164.5	817	1	—	—	
Johore	30	0.1	10	33.3	20	66.6	186	131.9	655	5	0.1	10	No yield from 10 acres due to dry weather conditions.
Total Main Crop	37,190	100.0	210	0.6	36,980	99.4	141	100.0	497	5,208	100.0	8,200	
Off-Season Crop, 1953	40	—	—	—	40	100.0	114	—	402	5	—	10	
Total 1953-54	37,230	—	210	0.6	37,020	99.4	140	—	497	5,213	—	8,210	
Total 1952-53	44,170	—	310	0.7	43,860	99.3	149	—	524	6,515	—	10,260	

Acreage to nearest 10 acres.
Rice production to nearest 10 tons.
Conversion rate 635 gantangs padi = 1 ton rice (i.e. milling recovery = 63 per cent.)